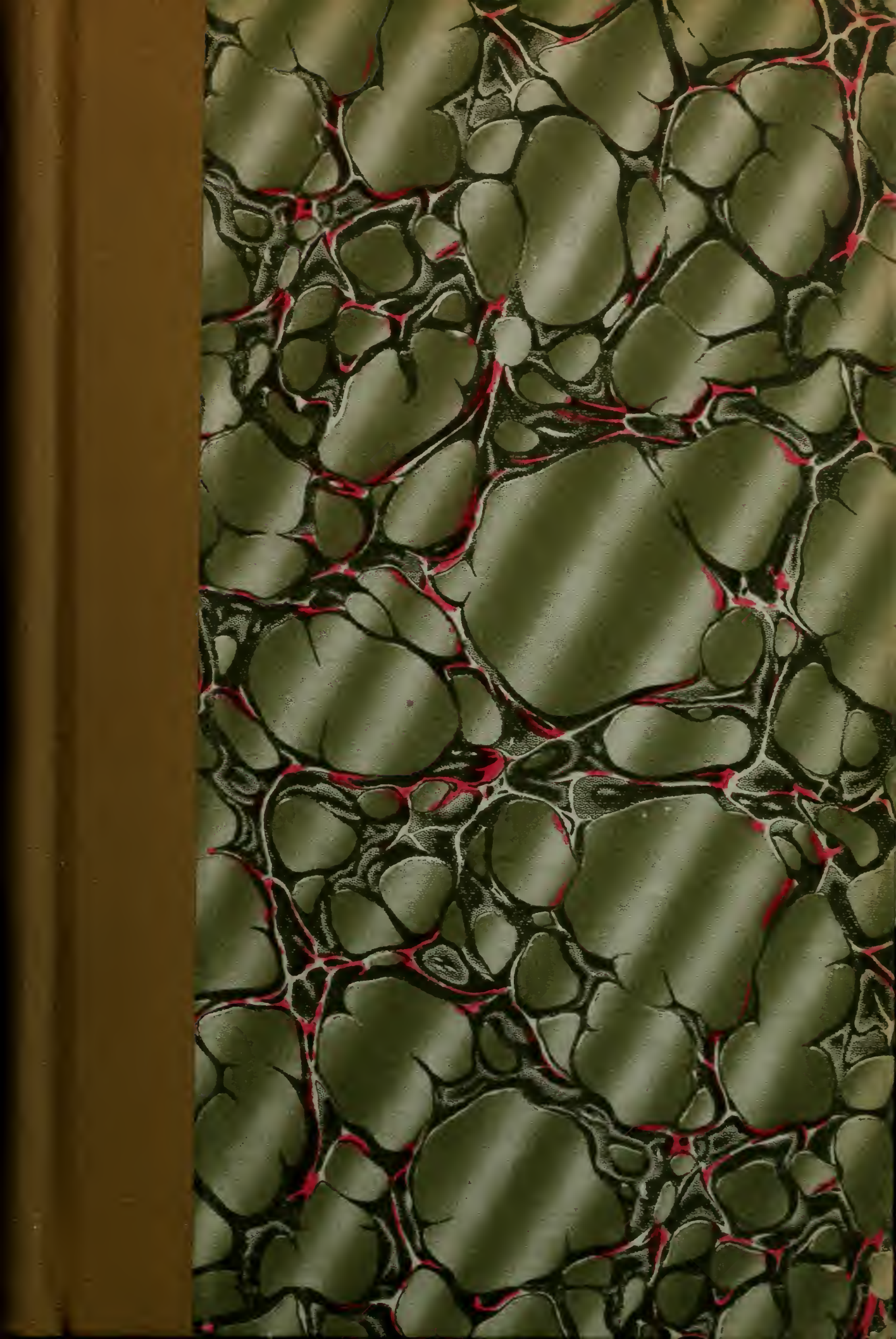

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DENTAL JOURNAL,

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C. W. SPALDING, D. D. S. M. D.,

EDITOR.

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*DR. DRAPER'S LECTURE ON EVOLUTION.**

ITS ORIGIN, PROGRESS AND CONSEQUENCES.

When, in the beginning of the present year, I received a request to deliver before this Institute a lecture on the subject of Evolution, I was at first disposed to excuse myself. Holding religious views which, perhaps, in many respects are not in accordance with those that have commended themselves to you, I was reluctant to present for your consideration a topic which, though it is in truth purely scientific, is yet connected with some of the most important and imposing theological dogmas. Whatever conclusion is eventually reached respecting it will have an influence on them. But there was that liberality of sentiment in your letter—that earnest desire for the ascertainment of truth—that I cast aside these hesitations, and am now here in obedience to your wishes.

Not that I can do justice in an hour to so great a subject, the literature of which ranges through many centuries. It is no

* The ministers of the Unitarian Church have recently held a meeting of their Institute at Springfield, Massachusetts. They had requested Dr. John W. Draper to deliver before them a lecture on the subject of Evolution. This accordingly was done on Thursday, October 11th. Some passages omitted in the lecture for want of time are here introduced.

new-fangled romance, as some would have us believe. It comes to us from a venerable antiquity. The theorems it expresses, and indeed on which it is based, have long ago been clearly known.

Considering the shortness of the time alloted me, the vast extent of the subject, the special character of this audience, and the nature of your request, I perceive that it is not an elaborate exposition of the evidence in favor of the theory of evolution that I must give, but a reference to those facts connected with it that are of chief interest to you. I must bear in mind that this is an institute of clergymen seeking information on a topic which they consider to have a bearing on their pursuits, and that it is from a corresponding point of view that I must present it.

Two explanations have been introduced to account for the origin of the assemblage of organic beings, plant and animal, that surround us. These are conveniently designated as the hypothesis of Creation and that of Evolution.

The hypothesis of CREATION asserts that Almighty God called into sudden existence, according to his good pleasure, the different types of life that we see. This hypothesis has an ecclesiastical form, that the world, with all its various animals and plants was created about six thousand years ago. The work was completed in six days, and was perfect, needing no improvement. At the close of each day the Almighty surveyed what he had done, and pronounced it very good. He brought all the animals thus made before Adam in the garden of Eden to receive their names. There was nothing more necessary, and on the seventh day he rested.

The hypothesis of EVOLUTION asserts that from one or a few original organisms all those that we see have been derived, by a process of evolving or development. It will not admit that there has been any intervention of the divine power.

The former of these hypotheses considers each species as independent of all the others; the second considers them as inter-related. Creation reposes on the arbitrary act of God; Evolution on the universal reign of law.

The hypothesis of Evolution in its scientific form presents three factors: 1. Heredity; 2. Environment; 3. Adaptation.

By heredity is meant the tendency manifested by an organism to develope in the likeness of its progenitor. By environment, the sum total of the physical conditions by which the developing organism is surrounded—the ambient world. By adaptation, the disposition so to modify as to bring an organism and its environment into harmony. This may be accomplished either by progression or retrogression.

As to the origin of organisms, it witholds, for the present, any definite expression. There are, however, many naturalists who incline to believe in spontaneous generation. In its most improved form it occcupies itself with two classes of problems, the direct and the inverse, considering in the former the effect of the environment on the organism, and in the latter deducing from the organism the nature of the environment. Thus Schleiden gathers from the structure of the stems of certain pine trees the distribution of climates at the time of their growth; and the ancient geographical connections of Madagascar and of Australia may be thus ascertained from their fauna.

After a very long and exhaustive survey of the plants and animals of his own locality, and of all that the power and favor of Alexander the Great enabled him to inspect, this is the result to which Aristotle, the prince of ancient Greek naturalists, came. In the eighth book of his "History of Animals," when speaking of the chain of living things, he says: "Nature passes so gradually from inanimate to animate things, that from their continuity the boundary between them is indistinct. The race of plants succeeds immediately that of inanimate objects, and these differ from each other in the proportion of life in which they participate; for, compared with minerals, plants appear to possess life, though when compared with animals they appear inanimate. The change from plants to animals is gradual; a person might question to which of these classes some marine objects belong." Aristotle referred the primitive organisms to spontaneous generation.

In the Museum of Alexandria the views of Aristotle were greatly expanded. There it was discovered that animated Nature presents something more than a mere connection; that each link of Aristotle's chain, if such a phraseology must be continued, was the descendant of its predecessor, the progenitor of its successor.

The idea now lost its mechanical aspect and assumed a physiological one.

We remark an important extension of this view after the conquest of Alexandria by the Arabians. If we compare the order of affiliation in successive points, it obviously presents a new fact —progress; and not progress only, but progress from the imperfect to the more perfect. This view included lifeless as well as living Nature. A practical application of it arose, to which the designation Alchemy was given. There is an unceasing progression, in which all things take part, to a better and nobler state. In this slow development Nature has no need to hasten; she has eternity to work in. Thus, in the mineral world, base and unworthy metals, such as lead and tin, are slowly on their way to perfection. They reach their goal on turning into gold. It is then for us to ascertain the favoring conditions, and, by imitating or increasing them, to hasten on the work.

The literature of those ages is pervaded with the idea of the mutability of everything—a proneness of all living beings to suffer transmutation with changes in the environment, or in the physical conditions to which they are exposed; and thus arises a slow but continuous procession, in the unceasing lapse of time, to the beautiful and good. We meet with this in both the serious philosophical works of the Mohammedans and in their lighter compositions of romance. They wrote books on the production of animals both by generation and putrefaction. They thought that in the germ there exists a latent force tending to evolve it. Ibn Roschd says: "There are, as respects the origin of living beings, two opposite theories. Some explain their existence by development, others by creation. The latter is the opinion of the Christians as well as of our Motacallemin." Abubacer accepts the reality of spontaneous generation by means of putrefaction and the action of the sun. These philosophers did not hesitate to say that the dogma of creation is an impossibility, an absurd opinion only fit for the vulgar who will believe anything. According to these elevated views, living beings are merely a movement of matter under the influence of heat. Man himself is like the flame of a lamp, a form or shape through which material substance is passing, receiving supplies, dismissing wastes and evolving force. As regards transmutation, Al Khazini says that an ani-

mal passes through successive stages of development, but we must not suppose that naturalists mean to say that "man was once a bull, and was changed into an ass, and afterward into a horse, and after that into an ape, and finally became a man."

Arabian philosophers had therefore speculated on spontaneous generation, and the conditions necessary for its occurrence; on the development of a germ by the latent force it contains; on the transmutation of species; and the production of the animal series. They had rejected the theory of creation, and adopted that of evolution. They had gained ideas respecting the unceasing dominion of law, but at these they had arrived through their doctrine of emanation and absorption, rather than from an investigation of visible Nature. In the religious revolt against philosophy that took place toward the twelfth century, these ideas were exterminated and never again appeared in Islam.

If the doctrine of the government of the world by law was thus held in detestation by Islam, it was still more bitterly refused by Christendom, in which the possibility of changing the divine purposes was carried to its extreme by the invocation of angels and saints, and great gains accrued to the Church through its supposed influence in procuring these miraculous interventions. The Papal Government was no more disposed to tolerate universal and irreversible law than its Paynim antagonist had been. The Inquisition had been invented and set at work. It speedily put an end not only in the south of France, but all over Europe, to everything supposed to be not in harmony with the orthodox faith, by instituting a reign of terror.

The Reign of Terror in revolutionary France lasted but a few months; the atrocities of the Commune at the close of the Franco-German War only a few days; but the Reign of Terror in Christendom has continued from the thirteenth century with declining energy to our times. Its object has been the forcible subjugation of thought.

The Mohammedans had thus brought the theory of evolution up to that point at which, for any further advance, clear views of the operation of law in the government of the world were necessary. In their speculations in this particular they had been guided by theological considerations. These were now to be re-

placed by others of a more definite and solid kind, derived from physical science.

The starting point of Christendom in the theory of evolution, for the Mohammedans had now ceased to philosophize, was the publication by Copernicus of the book "De Revolutionibus Orbium Celestium." In this the Pythagorean view of the emplacement of the solar system was revived. The way for this restoration had been prepared by such books as that of Cusa "On Learned Ignorance." He conceived of the universe as a vast organism, the life of which is the breath of God, and which has neither center nor circumference, but is infinite as its maker. Such views were largely prevalent in Italy, at that time the focus of infidelity, and there Copernicus had been. His work was followed by Kepler's great discovery of the three laws that bear his name.

After the invention of printing, the "Index Expurgatorious" of prohibited books had become essentially necessary to the Religious Reign of Terror, and for the stifling of the intellectual development of man. The Papal Government, accordingly, established the Congregation of that Index.

It was very plain that the tendency of Kepler's discoveries was to confirm the dominating influence of law in the solar system, as well as to destroy geocentric and anthropocentric theories. It was, therefore, adverse to the Italian theological views, and to the current religious practices. Kepler had published an epitome of the Copernican theory. This, as also the book itself of Copernicus, was placed in the Index and forbidden to be read.

The reformation came. It did not much change the matter. It insisted on the Mosaic views, and would tolerate no natural science that did not accord with them. Nevertheless, under the shadow of the political power it shortly gathered, Newton's "Principia" was safely published. The two great powers into which Christendom was divided held each other in check. The sectarian divisions fast springing up in Protestantism found occupation in their contentions with each other. The bearing which Newton's book had upon those already condemned consisted chiefly in this—it gave indisputable reasons that Kepler's laws are a mathematical necessity. For the finger of Providence

it substituted mechanical force. And thus the Reign of Law, that great essential to the theory of evolution, was solidly established.

But not alone did the discoveries of physical astronomy lead to these views. If the heavens were observed, the earth, also, was examined. There could no longer be any doubt that fossil remains were the relics of beings that were once alive, as Xenophanes in the old times, and Da Vinci and Palissy more recently had affirmed—not mere *lusus naturæ*; that the earth's strata were not all of the same age; that in the oldest no fossils could be found; that there had been a time when there was no life on the earth; that of the strata some are of marine, some of fresh water formation; that they are often intercalated like leaves in a book, and therefore cannot be referred to any single cataclysm such as the deluge.

From considerations connected with the primary rocks, Leibnitz (1680) had inferred that the earth was once at a far higher temperature than now, and in fact must have been in an ignited state; that it had undergone a gradual cooling. Werner subsequently introduced the Neptunic theory, and Hutton the Plutonic. These cosmographical theories were, however, of less importance than what was done in paleontology. It was discovered that while similar fossil remains extended over vast horizontal surfaces, different fossils are found to succeed each other very rapidly when a vertical examination is made. There is a geological as well as geographical distribution of plants and animals—geological as to time, geographical as to surface.

In the works of Maillet (1748), and again in those of Buffon, the old doctrine of evolution reappears. A more formal presentment was, however, made by Lamarck in his "Philosophic Zoologique," published in 1809. He advocated the doctrine of descent, and announced the propositions now known as Darwinism. According to him, organic forms originated by spontaneous generation, the simplest coming first, and the complex being evolved from them. Variations and transmutations occur through external influences, the environment modifying the organism, and as these in the lapse of time become essential differences, new species arise. Moreover, wants experienced cause the will to develop new organs by the modification of previously exist-

ing ones, and these are transmitted by heredity or generation. Organisms are developed out of one another; so far from being permanent, they have only a temporary existence.

Though an organism tends to be like its progenitor, it will undergo changes by the use or disuse of its parts; by the former it is developed, by the latter deteriorated. The changes produced thus, or by the environment, always have been, and always will be, continuous, not catastrophic.

Lamarck recognized the struggle of each against all. He saw plainly the influence of heredity, and understood the relation of environment and adaptation. He defined in the clearest manner the doctrine of transmutation and theory of descent. According to him, if time enough be allowed, any modification may take place.

So far from meeting with acceptance, the ideas of Lamarck brought upon him ridicule and obloquy. He was as much misrepresented as in former times the Arabian Nature philosophers had been. The great influence of Cuvier, who had made himself a champion of the doctrine of permanence of species, caused Lamarck's views to be silently ignored, or, if by chance they were referred to, denounced. They were condemned as morally reprehensible and theologically dangerous. In this, the authority of Cuvier in regard to evolution acted as the authority of Newton had done in regard to the undulatory theory of light.

In like manner the views of Oken met with resistance, especially his deduction that the highest animals are the result of development, not of creation. Man, he significantly says, has been developed, not created. He conceived all Nature to be in a process of evolution. His demonstration that the bones of the skull are only vertebral modifications, however, reconciled many persons to a more favorable opinion of his hypothesis of development.

Geoffrey St.-Hilaire (1828) did not doubt that animals now living are descended by an unbroken succession from extinct ones, by transformation from form to form; that different species are degenerations of the same type, being due to the influence of environment (*monde ambiant*). He thus became the opponent of Cuvier and did very much to break down the influence of that zoologist. In these variations he considered that the organism is

passive, differing in this from Lamarck, who thought it active. His views of the influence of the environment were very precise: thus he thought that birds arose from reptiles, through the diminution of carbonic acid and increase of oxygen in the air, at the time of the formation of coal; the activity of the animal circulation becoming greater, and the reptile scales being transformed into the feathers of the bird. As is now known, this was substantially a correct interpretation.

Though the principles of the doctrine of evolution were thus thoroughly understood, the control of heredity, the influence of environment, the modeling by adaptation, public attention failed to be drawn to it until 1844, when there was published in England an anonymous book under the title of the "Vestiges of the Natural History of Creation." In this the author set forth Lamarck's views, and the work, being clearly and attractively composed, passed through a great many editions. Very fortunately, it may be said, it accepted some unsubstantiated facts and contained some physical mistakes. These tempted many skillful and bitter criticisms of hostile theologians. The reviews and journals were filled with their attacks and answers to them. Thus, happily, the whole subject was brought into such prominence that it could be withdrawn into obscurity no more.

In the discussions of this book the author made use of a most important anatomical discovery, that even in the case of the highest species, man himself, the embryo does not simply grow or increase in size, but passes in succession through a series of forms, which, examined from epoch to epoch, are totally dissimilar. It had been the vulgar opinion that after the first moment of conception all the parts of the animal that is to be are present, and that they simply grow. The human embryo, according to this, reaches birth very much in the same way that the infant passes from birth to manhood. That was, I say, the vulgar opinion, but, in laying before our eyes the development of the individual, God has given us a revelation of the course of life by the world.

The evolutionary history of animals establishes that there is not this homogeneousness of development, but that the higher pass through the forms of the lower; that the mammal, for instance, passes through stages at which the lower vertebrates re-

main fixed. All are therefore pursuing a journey along the same road, though some may travel to a longer, some to a shorter distance. There is thus a parallelism between individual and race development; a close connection between the phases of development in the individual and in the species.

The type of each animal is from the first as it were embedded in the embryo and controls its evolvement. The embryo never makes any attempt to change from one type to another, but sometimes the tendency to a form and not the form itself is transmitted.

The parallelism that exists between the career of the individual and the career of the race reappears in the life of the world. There is a resemblance—indeed more than a resemblance—between the successive forms through which man himself in his prenatal life has passed, and those that have appeared in myriads of ages in the biography of the earth. Common sense revolts against the idea that these transformations are in the individual due to divine intervention. In that, and in the case of the earth, they must be due to natural law.

In the year 1859 there was published by Mr. Darwin a work on "The Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life."

In this and in other subsequent works, it is shown that the individuals of each species tend to increase in a very rapid ratio—an increase more rapid than that of their means of subsistence. Each has, therefore, to contend with his competitors; and hence all must exhibit "a struggle for existence."

But modifications are incessantly taking place in the form and characteristics of individuals, giving to some an advantage, to some a disadvantage, as compared with their competitors. Hence, the former will prevail, the latter will succumb in the struggle. This, in the language of the hypothesis is formulated "the survival of the fittest."

And as the pigeon fancier or other person who devotes himself to the breeding of animals can produce any form he wishes by selecting its progenitors and pairing them together, exercising thus artificial selection, so if any of the chance forms that have arisen should be better adapted than others for perpetuation, they will be perpetuated, or Nature may be said to have made a se-

lection. Hence the term "natural selection," which has been made to designate this hypothesis.

It is to be regretted that this phrase "natural selection," has been introduced. It is very unscientific, very inferior to the old expression adaptation. It implies a personification of Nature. It is anthropomorphic. But nature never selects, never accepts or rejects, knows nothing about duties, nothing about fitness or unfitness. Nature simply obeys laws.

Natural selection is thus supposed to perpetuate an organism after adaptation to its environment has taken place. The change implied by adaptation must precede it. It should be regarded rather as a metaphorical expression than a scientific statement of an actual physical event.

Darwinism, therefore, does not touch the great question as to the manner in which variation of organisms arise. It only teaches how such variations are perpetuated.

The publication of Humboldt's "Essay on the Geography of Plants" (1805) first formally drew the attention of botanists to the connection between the distribution of plants and the distribution of heat on the surface of the earth. As an advance is made from the equator toward the pole in either hemisphere, the mean annual temperature declines, and in succession a series of vegetable zones is encountered, merging gradually into each other, though each, where best marked, is perfectly distinguished from its successor. In the tropics there are the palms which give so striking a characteristic to the landscape, the broad-leaved banannas, and great climbing plants throwing themselves from stem to stem like the rigging of a ship. Next follows a zone of evergreen woods, in which the orange and citron come to perfection. Beyond this another of deciduous trees, the oak, the chestnut, and the fruit trees of our orchards. Here the great climbers of the tropics are replaced by the hop and the ivy. Still farther is a belt of conifers, firs, larches, pines and other needle-leafed trees; and these lead through a range of birches, becoming more and more stunted, to a region of mosses and saxifrages, but which at length has no tree nor shrub; and finally, as the perpetual polar ices are reached, the red snow alga is the last trace of vegetable organization.

A similar series of facts had long previously been observed by

Tournefort in an ascent of Mount Ararat. The distribution of vegetation from the base to the top of the mountain bears a general resemblance to the distribution from the base to the polar regions. These facts were generalized by subsequent observers. It was established that there exists an analogy between horizontal distribution on the surface of the globe, and vertical distribution at different altitudes above the level of the sea. Even in the tropics, if a mountain be sufficiently high, a short ascent suffices to carry us from the characteristic endogenous growths at its foot through a zone of evergreens into one of deciduous trees, and this again into one of conifers, the vegetation declining through mosses and lichens as we reach the region of perpetual snow.

In these cases of horizontal and vertical distribution which thus present such a striking botanical resemblance, there is likewise so clear a meteorological analogy that it is impossible to avoid the conclusion that the distribution of plants depends very largely on the distribution of heat. And, indeed, what better illustration of the influence of heat could we have than this, that by artificially adjusting the temperature of hot-houses we can cause any plant to grow in any latitude?

But temperature alone does not determine the distribution of plants. If it did, we should find the same species in the same isothermal zones. Throughout the old continent, with the exception of the torrid zone, heaths abound; but in America not a single heath occurs. In the New World, through forty degrees on each side of the equator, the cactus tribe flourishes; in the Old not a single cactus is to be seen—the spurges there replace them. So, again, in Australia, the forests present a melancholy, a shadeless character, from their casuarinas, acacias, eucalypti, whereas, if temperature alone were concerned, they should offer the same aspect as the forests of North America and Europe.

As regards animals the same remark may be made. In the temperate zone, eastward beyond the Caspian, there are men whose complexion is yellow; in Europe the complexion is white; the American Indian is red. Asia has its Tibet bear, Europe its brown bear, North America its black bear. The European stag finds in America its analogue in the wapti, its Asiatic in the musk-deer. The wild-ox of Lithuania differs from

the North American buffalo, and this, again, from the Mongolian yak. The llama in America replaces the camel of Asia, the puma replaces the lion. Brazil has had in times long past representatives of its existing sloths and armadillos. Australia, which has isothermal zones like those of other continents, has no apes or monkeys, no cats or tigers, no wolves or bears, hyenas, horses, squirrels, rabbits; no woodpeckers or pheasants. Instead of them it has the kangaroo, wombat, ornithorhynchus, cockatoos, and lories, nowhere else found.

Then, though heat is a dominating influence in the distribution of plants and animals, it is by no means the only one. There are also other conditions, such as the supply of water, the composition of the soil, the access of light, etc. It has been found convenient to group all these together, and to speak of them, as I have already stated, under a single designation, "The Environment."

Change in the environment, and change in its organisms, go hand-in-hand. Should the warmth of the tropics be diffused into the polar circle, a tropical vegetation would replace the vanishing snows. Should the ices of the poles spread over the temperate region, the reindeer would accompany their invading edge.

While the environment thus influences the organism, the organism reacting influences the environment. The most striking instance of this, perhaps, will be found on comparing the constitution of the atmosphere before and since the carboniferous epoch. Prior to that epoch, all the myriads of tons of coaly substance now inclosed in the strata of the earth existed as carbonic acid in the air. By the agency of the sunlight acting on the leaves of the luxuriant vegetation of those times, this noxious gas was gradually removed, and replaced by an equivalent volume of oxygen. A hot-blooded, quickly-respiring animal could not possibly exist in an atmosphere laden with carbonic acid. Anterior to the coal deposit, the fauna was cold-blooded and slow-respiring. The flora thus changed the aerial environment, and this, in its turn, reacting, changed the fauna.

It is on all sides admitted that plants tend by their removal of carbonic acid from the air, replacing it by oxygen, to compensate for the disturbance occasioned by animals. In this way, through very many centuries, the same per centage constitution

of the atmosphere is maintained, the sum total of vegetable being automatically adjusted to the sum total of animal life—automatically, and not by any interference of Providence—a fact of great value in its connection with the theory of evolution. For, if we admit what has been conclusively established by direct experiment, that plants would grow more luxuriantly in an atmosphere somewhat richer in carbonic acid than the existing one, we may see how upon this condition depends a principle of conservation, which must forever retain the air at its present constitution, no matter how animal life may vary.

Cuvier speaks of the inferior organisms as furnishing us with a series of experiments made by the hand of Nature, an idea often quoted and often admired, but which, perhaps, is scarcely consistent with enlarged conceptions of the system of the world. An organism, no matter how high or low, is not in an attitude of isolation. It is connected by intimate bonds with those above and those beneath. It is no product of an experimental attempt, which, either on the part of Nature or otherwise, has ended in failure or only partial success.

The organic series—an expression full ot significance and full of truth implies the inter-connection of all organic forms—the organic series is not the result of numberless creative blunders, abortive attemps or freaks of Nature. It presents a far nobler aspect. Every member of it, even the humblest plant, is perfect in itself. From a common origin, or simple cell, all have arisen; there is no perceptible microscopic difference between the primordial vesicle which is to produce the lowest plant, and that which is to produce the highest, but the one, under the favoring circumstances to which it has been exposed, has continued in the march of development, while the career of the other has been stopped at an earlier point. The organic aspect, at last assumed, is the representation of the physical agencies that have been at work—the environment. Had these for any reason varied, that variation would at once have been expressed in the resulting form, which is, therefore, actually a geometrical embodiment of the antecedent physical conditions. For what reason is an offspring like its parent, except that it has been exposed during development to the same conditions as was its parent. Comparative physiology is not a fortuitous collection of experiments.

Our noblest conception of it is the conception we have of analytical geometry. Each member of the organic series is an embodied result of a discussion of the equation of life for one special case.

It was a felicitous thought of Descartes that we may represent a geometrical form in an algebraic equation, and, by the proper consideration and discussion of such an expression, determine and delineate all the peculiarities of such a form; that here it should become concave, there convex; here it should run out to infinity, there have a cusp. The equation determines all the peculiarities of the form, and enables us to construct it. In like manner, all living and lifeless forms are related; an increase in the value of one condition carries development forward in one direction; an increase in the value of another condition determines development in another way, and these variations give rise in their succession to the whole organic series.

Nature ever geometrizes and ever materializes. Every organism is the result of the development of a vesicle, under given conclusions, carried out into material execution. It is the incarnation, the embodiment, the lasting register of physical influence, the daughter of the environment.

Let us now rapidly survey the changes that have taken place in the earth's organisms:

In the earliest, or primordial period, there existed of plants only water-organisms—tangled sea-weeds. Then in the following, the primary, came the more perfect cryptogams, such as ferns. Then followed, in the secondary, pine forests. In the coal period the phanerogamia developed out of the more perfect cryptogamia. Not until the chalk did the higher corollifloræ appear. In the beginning of the tertiary the earth had sufficiently cooled at the poles, climate-zones were produced, and the land was covered with leaved forests. Flowerless plants had been succeeded by flowering ones, the latter first without a distinct corolla, and then by those with one; and of these, first the lower and then the higher.

Turning to the order of succession of animal life—of the primordial, the forms are skulless; then in the following, the primary, came fishes, first those with the heterocercal tail, as in the embryos of existing ones. In the secondary, reptiles, and

out of them birds were developed; the decreasing amount of carbonic acid and the increasing amount of oxygen permitting that change. Of birds, the earliest had a long, lizard-like tail, composed of thin vertebræ, to every one of which were attached strong, rudder-like feathers in pairs. The same formation of the tail part of the vertebral column still occurs transiently in the embryos of later birds. The transition from the reptile to the bird is manifested by some of the latter having teeth set in one order in grooves, in another in distinct sockets. Among mammals as among fishes the imperfect appeared first. About the middle of the mesolithic period, out of a branch of the cloacal animals the marsupials were evolved; and in the beginning of the tertiary the placentals were developed out of the marsupials. The latter were at one time distributed over the whole earth; now they are fast approaching extinction. In Europe, Asia, Africa, not a single member of the group remains. The cloacal animals, the marsupials, the placentals, stand therefore in an order of succession.

Such has been the order of evolution in Europe. For its order in America I may refer you to the recent admirable address of Prof. Marsh before the American Association for the Advancement of Science. The general conclusions at which we arrive in one case are substantiated in the other.

In accordance with his descent, the cloacal structure exists in man in the earlier period of his embryonic life. The separation into two openings takes place about the twelfth week of his uterine development. Shall we not, therefore, infer from the evidence of his embryonic forms that he has been developed step by step out of the lower vertebrates?

In the early stages of their evolution, amphibia, reptiles, birds cannot be distinguished. The first steps of development in all vertebrates are identical. Man passes now through the same series of transmutations which his animal predecessors passed through in immense spaces of time, long ago. The progress he makes in the lapse of a few days in the darkness of the womb is the same that has been followed by the procession of animated Nature in the lapse of myriads of centuries in the daylight of the world.

From a comparison of their studies embryologists and paleon-

tologists unite in the conclusion that individual development is a rapid repetition of race-development, and that the paleontological movement is to be interpreted by the embryonic. The connecting links supposed to be missing in the former may be sought for in the latter. Individual development, paleontological development, and comparative anatomy, through their combined evidence guide us to a deduction of the genealogy of any organism. The dominion of law is everywhere manifest. The capricious intrusion of a supernatural agency has never yet occurred.

Each of the geological periods has its dominating representative type of life. Perhaps it may be asked: "How can we be satisfied that the members of this long series are strictly the successive descendants by evolution from older forms, and in their turn the progenitors of the later? How do we know that they have not been introduced by sudden creations, and removed by sudden extinctions?" Simply for this reason: The new groups make their appearance while yet their predecessors are in full vigor. They come under an imperfect model which very gradually improves. Evolution implies such lapses of time. Creation is a sudden affair.

A striking illustration of this is offered by two of the most imposing types of life, the reptile and the mammal. The former is the characteristic of the secondary, the latter of the tertiary period. In the secondary, when reptile life was at its culmination, there were reptiles flying in the air, swimming on or in the sea, crawling on the land, or climbing the trees. After this type of life had reached its culmination, and extinction began to set in, that process went forward in a gradual and orderly way. The flying lizards were the first to disappear, then those of the sea; they now have scarcely any representative left. The fluviatile and terrestrial ones, though greatly diminished both in numbers and size, still maintain a struggle for life; but the complete dying out of animated forms, though irresistible, requires for its completion countless centuries.

While reptile life was in full vigor, mammal life was introduced. It came under the lowest forms, the imperfect orders appearing first.

What does the coexistence of two different forms of life,

through immense lapses of time—the one declining and on its way to disappearance, the other marching forward to increase—what does this overlapping mean? Not sudden creation, but slow development. The environment is slowly becoming unsuitable to the one, and slowly becoming suitable to the other.

If time permitted, I would ask your close attention to rudimentary organs, for they illustrate strikingly the theory of evolution. They are organs existing in an apparently undeveloped and useless condition, such, for instance, as the incisor teeth in the midbone of the upper jaw in embryos of common cattle, the rudimentary wings of the penguin and dodo, the mammæ of the male mammalian, the subcutaneous feet of certain snakes. In the embryos of whales teeth are found in the jaw, precisely as we find them at birth in the human infant. In the latter instance, we think we see a wise provision and foresight of Nature, which does not give to man these masticatory organs before the time they are wanted. But what are we to make of the parallel case of the whale? Shut up as these rudimentary teeth are in the interior of the jaw, never to be developed and never to be used, does not that look something like a useless work? And why has Nature, in the case of certain snakes, placed under the skin bony representatives of the extremities, the movements of those animals being by the use of the ribs, and feet never being wanted?

We may also turn to the vegetable world, and there we find rudimentary organs, excesses and deficiences of development. As Treviranus says, adaptation to the surrounding world may be shaped either by gradual development or by degeneration, which is equally effective. The same organ may be expanded into a compound leaf, or degenerated into a scale. Development can turn a reptile into a bird; degeneration can turn it into a serpent. Any flower may be regarded as a transformed branch—that which might have evolved into a leaf turns indifferently, as circumstances may direct, into a sepal, a petal, or a stamen.

Rudimentary organs come into existence as part of a general plan. They are the manifestation of heredity in the type of life of the animals or plants in which they occur. They prove that the form has been developing, not teleologically, or for a purpose, but in obedience to law.

Now I have answered, and I know how imperfectly, your question, "How does the hypothesis of evolution force itself upon the student of modern science?" by relating how it has forced itself upon me, for my life has been spent in such studies, and it is by meditating on facts like those I have here exposed that this hypothesis now stands before me as one of the verities of Nature.

In doing this I have opened before you a page of the book of Nature—that book which dates from eternity and embraces infinitude. It reveals millions of suns and worlds of surpassing glory. Among its most insignificant pages are the vast rock-strata of the earth. We have been looking at some of them. No Council of Laodicea, no Tridentine Council, is wanted to indorse its authenticity, nothing to assure us that it has never been tampered with by any guild of men, to perpetuate their influence, secure their profits, or otherwise promote their ends.

Then it is for us to study it as best we may, and to obey its guidance, no matter whither it may lead us.

And this brings me face to face with the third division of my subject. I have spoken of the origin and the progress of the hypothesis of evolution, and should now consider the consequences of accepting it. Here it is only a word or two that time permits, and very few words must suffice. I must bear in mind that it is the consequences from your point of view to which I must allude. Should I speak of the manner in which scientific thought is affected, should I dwell on the influence this theory is exerting on general knowledge, I should be carried altogether beyond the limits of the present hour.

The consequences! What are they, then, to you? Nobler views of this grand universe of which we form a part, nobler views of the manner in which it has been developed in past times to its present state, nobler views of the laws by which it is now maintained, nobler expectations as to its future. We stand in the presence of the unshackeled, as to force; of the immeasureable, as to space; of the unlimited, as to time. Above all, our conceptions of the unchangeable purposes, the awful majesty of the Supreme Being, become more vivid. We realize what is meant when it is said, "With Him there is no variableness, no

shadow of turning." Need I say anything more in commending the doctrine of evolution to you?

Let us bear in mind the warning of history. The heaviest blow the Holy Scriptures have ever received was inflicted by no infidel, but by ecclesiastical authority itself. When the works of Copernicus and of Kepler were put in the Index of prohibited books, the system of the former was declared, by what called itself the Christian Church, to be "that false Pythagorean system, utterly contrary to the Holy Scriptures." But the truth of the Copernican system is now established.

There are persons who declare of the hypothesis of evolution, as was formerly declared of the hypothesis of Copernicus, "It is utterly contrary to the Holy Scriptures." It is for you to examine whether this be so, and, if so, to find a means of reconciliation. Let us not be led astray by the clamors of those who, not seeking the truth and not caring about it, are only championing their sect, or attempting the perpetuation of their own profits.

My friends, let me plead with you. Don't reject the theory of evolution. There is no thought of modern times that more magnifies the unutterable glory of Almighty God? Remember, I beseech you, what was said by one of old times: "Ye men of Israel, take heed to yourselves what ye intend to do. And now I say unto you, if this counsel be of men it will come to naught; but if it be of God, ye cannot overthrow it, lest haply ye be found to be fighting against God"—shall I finish the quotation?—"and to him they all agreed!"

We often hear it affirmed that our age is becoming more and more irreligious, and that men wantonly reject sacred things of which their ancestors approved. But I think we may profitably inquire whether very much of this is not due to the profound changes that are taking plsce in our conceptions of the Supreme Being? Things and acts which at one time men attributed to him without hesitation, they can attribute to him no more. They have learned to demand of every dogma, "Is it derogatory to the awful majesty of God?"

These modifications of opinion have had no little to do with the progress of the subject we have been considering. Let us ever bear in mind that the doctrine of evolution has for its foundation not the admission of incessant divine interventions, but a

recognition of the original, the immutable fiat of God. In whatever direction we commune with Nature, the dominion of universal, of everlasting law confronts us.

The establishment of the theory of evolution has not been due to any one science, but is attributable to the conjoint movement of all. It is due to the irresistible advance of human knowledge. To refer it to geology alone, as is often done, is altogether a mistake. It was not possible that astronomy should fail to maintain her grand position. She took the lead in the intellectual revolution which marks the close of the middle ages. Single handed and alone, she fought and won the great battles of the globular form of the earth, the central sun, the plurality of worlds. It cost her the blood of some of her leaders. For some there was the fagot, the rack, the prison cell, the scourge. But they departed from their tormentors rejoicing that they were accounted worthy to suffer even death in this cause. And now she found stepping-stones for herself in the trackless infinitude of space, and beckoned her comrade sciences to come and share with her the glorious view she had gained of the majesty of the universe. Anatomy, both human and comparative, paleontology, chemistry, physiology, microscopy, even philosophical history, have given their aid. Wherever any one science has made a marked advance, its movement has been covered by some of the others, and the ground thus occupied secured. As matters now stand, all are well to the front—the entire line is dressed.

It often takes many victories to establish one conquest. Knowledge, fresh from so many triumphs, unfalteringly continues her movement on the works of Superstition and Ignorance.

Now, in parting, let us bear this in mind: So great is the intellectual advance men have made, that questions which at one time divided Christendom into sects are now far in the rear. Those which once separated good men socially, are passing out of sight. They are replaced by others of a very different order. Among such, one of surpassing importance confronts us—the eternal reign of law. Let us bear in mind what the theory of evolution so loudly proclaims: "We are what we are because the universe is what it is." If it acts upon us, we react upon it. Our conception of the sphere of being we occupy is enlarging, and

we are thus brought into close relationship with all that is beautiful on earth, all that is magnificent in the heavens.

Then let us reverently commune with Nature. Let us try to raise our eyes from the varying phenomena of the world, to the solemn grandeur of that silent, that imperishable reign of law that governs all those changes; let each of us earnestly address to himself the remonstrance of "The Minstrel:"

"Oh! how canst thou renounce the boundless store
Of charms that Nature to her votary yields,
The warbling woodland, the resounding shore,
The gloom of groves, the garniture of fields,
All that the genial ray of morning gilds,
And all that echoes to the song of even,
All that the mountain's sheltering bosom shields,
And all the dread magnificence of heaven—
Oh! how canst thou renounce, and hope to be forgiven?"

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GENESIS.*—I.

BY HIRAM CHRISTOPHER, M. D., OF ST. LOUIS.

We naturally seek to know the causes of things. The desire is instinctive to our minds. We are not satisfied with the simple knowledge of phenomena—of matter and its numerous combinations, or of the laws, forces or agents concerned in the production of material or psychical phenomena. Whilst the world of dead matter affords the scientist a wide field for observation and experiment, and the exercise of his mental powers, and contributes largely to his intellectual pleasure; yet he is not satisfied with the simple knowledge and the pleasure it affords him. He desires to do more than simply observe or note phenomena, to collate facts and deduce principles; he especially desires to know

*Life, Matter and Mind; by Dr. Lionel Beale.

how matter and its forces came to be. In looking on these he asks, Whence are they? How came they here? Had they a beginning? Is matter eternal, or do it and its forces owe their existence to some pre-existing power? Was there never a time when they were not, or was there an antecedent cause for all these? If so, what was that cause? Was it a power as intimately and as closely connected with matter as are its forces, or was it a power wholly distinct and separate from these, and consequently *supernatural?* If the latter, must not its *nature* be also supernatural? If an adequate cause can be found for all the phenomena which the world presents to us, material and psychical, that cause must be found either in the forces of matter, or in some supernatural power in every way different and distinct from the natural—that which we see in matter, its forces, and in material phenomena. Whether we shall include psychical phenomena, witnessed only in the higher organisms, among *natural* phenomena, will depend on the determination of the question whether the vital agent is a physical force.

Reason demands an adequate cause for the effect we observe, and cannot be satisfied until such a cause has been found as will rationally and fully account for all the phenomena observed. It must be a cause fully adequate and sufficient; one that will leave no important fact under the cloud of doubt. Such a cause I now attempt to discover from the phenomena of the material and organic worlds, without recourse to any evidence not furnished by these two departments of nature, and I invite the closest scrutiny to the argument; for I desire not to impose upon myself nor on any one else, by any sophistical or illogical reasoning, or the use of any questionable fact or principal.

As to the existence of matter there can be no doubt. We are conscious of the fact, and we cannot be persuaded that consciousness deceives us. But how came it here? But two answers can be given to this question; only two hypotheses can be conceived of that will account for the fact of its existence. It had an origin or it is eternal. It was created by a superior power, or it had no beginning. If its origin was supernatural, that supernatural cause was adequate to the production of all the phenomena which the organic and inorganic worlds present. If it be eternal and had no connection with any other existence or power, then

we must find in the forces of matter, agencies or powers fully competent for the production of these same phenomena. To determine that physical forces were the potential causes of all phenomena, both physical and psychical, and place the conclusion beyond question, two facts must be established. Until this is done the hypothesis of the eternity of matter, and the assumed competency of its forces are pure fictions.

1st. It must be established that matter is eternal and had no connection in its existence with any foreign power. Neither of these propositions can be proved. Both are simply impossibilities. On the contrary it can be established that matter is not eternal, and that a foreign power did intervene, and become the real author of material and psychical phenomena.

2nd. That physical forces are capable of creating living organisms and of originating vital phenomena. These capabilities of material forces have not yet been shown to exist. There is, therefore, no reason or fact which can warrant the opinion that physical forces originated the material and mental phenomena observed in the two departments of nature.

Spirit, as an existence and cause of phenomena, the physicist rejects as beyond the domain of the phenomenal, and without recognition in nature. He thinks that science has no knowledge of such a thing; that it can have no cognizance of it; consequently its phenomena, admitting the existence and presence of such, are not proper subjects for scientific investigation or experiment. In discarding the agency of any such power in the production of psychical phenomena, the scientist claims that these phenomena have a material origin, and are, consequently, of a material nature. Though the scientist may refuse to recognize the existence of any agent or power above, beyond, or external to matter or its forces, as the cause of phenomena, nevertheless, intelligent men have the conception of spirit, and speak of it as an intelligent power, and ascribe to it certain observed phenomena; and we submit that such a notion cannot be dismissed as the dream of an enthusiast, and, therefore, unworthy of scientific inquiry, and more particularly as the hypothesis that spirit lies at the origin of matter and mind, accounts for all the observed phenomena in either the organic or inorganic worlds. It will be seen, I think, that the scientist is unscientific in reject-

ing spirit as an indispensable factor in the solution of the problem presented by the psychical phenomena of animals. It is not an idea that is confined to the Jewish or Christian scriptures, and the result of inspiration. The Greeks had their *pneuma* and *psyche* and distinguished between them, assigning to the former the distinctive and differential attribute of man, and to the latter the psychical phenomena of animals. They not unfrequently, however, employed them interchangeably, and as synonymous, which they could not have done if they had not conceived the *psyche* and *pneuma* as being identical as to nature.

It seems to be the tendency of modern science, if certain men regarded by the world as leading scientists, are to be taken as the leaders, to regard matter and its forces as eternal, or, at least, as the efficient and adequate cause of all phenomena, both physical and psychical. This modern school holds that "mind, emotion, intelligence and will, were once latent in a fiery cloud;" that "all our philosophy, all our poetry, all our science, all our art—Plato, Shakspeare, Newton and Raphæl are potential in the fires of the sun," which means that all phenomena, material, vital, and mental are the work and creation of the forces of matter; that mind, and will, and genius of every kind are but the functions of organisms originated, developed, and perfected by the operation of forces potent or latent, in a fiery cloud. It discards and repudiates all other power or agency as a proximate or remote cause of phenomena, holding that physical forces are competent and adequate for the production of all that we see and know of the two great departments of nature. Such a view necessitates the belief that matter is eternal, and a denial of any genesis for it whatever. To go farther, to seek to know whether the belief in the eternity of matter is rational or not—to seek for any power outside of the domain of the material, is to be unscientific—to pass the limits to which scientific inquiry must be confined. This is a convenient philosophy that drops investigation just at the point where it becomes difficult and interesting—at the point where the mind has awakened to a true scientific interest in the problem which phenomena have forced upon our attention! Phenomena are before us, and the true scientist and honest seeker after truth, will not be content, when estimating the potentialities of nature, until he has found an ultimate

cause on which all things depend and from which they have proceeded.

As far as we know, the forces of matter are inherent in, and inseparable from it. We, at least, cannot separate or isolate them. Is it possible for iron to exist without its chemical affinities? Is not chemical affinity inherent in matter? As a fact we know that chemical affinity is active and potent wherever the proper and necessary conditions are present. The same is true of other physical forces, and they are always active whenever the necessary conditions are present. We cannot destroy their power and activity if we would. Hence when gravitation acts bodies will be drawn together; when cohesion is active, particles form masses; and when atoms of different elements come within the limits of chemical affinity, a *tertium quid* will be formed. This law is invariable, like all the laws of nature, and always works the same result. Hence, union between elements, or compound radicals, will ever be found when the physical conditions necessary to the operation of these laws are present, and just so long as the conditions continue to be present. These laws and forces have been operative from the beginning, and material compounds have continued to be formed from the beginning, and are yet being formed, and will continue to form so long as the present physical conditions remain as they are. Chemical affinity gives rise to material compounds, but is not always sufficient of itself. Heat is necessary to many. Hence, if certain compounds are found, which we now know require heat to effect the union of their elements, we are justified in concluding that it was present when such compounds were formed. Illustrations of this law we have in great abundance. If silicic acid and lime be commingled they will remain unchanged until heat be applied to bring their atoms within the limits of their attraction.

That heat was present and active in the earliest combinations of matter the leaders of the modern school of science believe and teach; for they hold that matter was once in a gaseous or fluid state, and that this state was produced by heat, or at least that the heat, resulting from atomic combinations, was so intense as to fuse or vaporize the body so soon as formed. We may admit that such was the fact, and yet deny that all future phenomena have the same or alike genesis. Though in such a fiery cloud

all the physical forces are present and active, we cannot conclude that they were the germinal power of all future phenomena, as is claimed by the modern scientist, just as we have in the seed the potentialities of the plant in all its growth, development and fruiting. But this much their presence and activity do show; that the bodies which they are capable of forming from the elements of matter. are formed, and invariably formed under purely physical conditions.

Now, if the vital force belongs to matter, and is in fact a force of matter, as chemical affinity, heat or electricity, then it was present in the fiery mist in which matter once appeared. It must also inhere in matter, and produce vitalized bodies as readily as chemical affinity produces chemical compounds, or cohesion masses of the particles of matter, when the physical conditions necessary to its operations are present. So long as a sufficient degree of heat was present in the ancient world, so long were silicates formed, and so long were all other compounds of matter impossible, which are decomposed at such a temperature. The same should be true as respects vitalized bodies or living organisms. They are possible only under certain conditions; nevertheless if the vital agent be truly a material force, it should produce living organisms, as readily and as constantly, as does chemical affinity chemical compounds when the necessary conditions are present. The production of living organisms should be as possible and as common as the production of inorganic bodies. But is this the fact? Do living organisms arise from the spontaneous action of physical forces? Is nothing else necessary to their production? Are vital conditions the same in fact as the physical? This ought to be so, if the vital force is but a material force.

Carbonates did not appear on the earth until the temperature had become so low as to allow the union of the acid and the base, nor did living organisms appear until the physical conditions had become such as to permit their existence and perpetuation. Geology fully assures us of this fact. It was the principle governing the appearance of living organisms at every period of the earth's history, that the necessary physical conditions always preceded the appearance of new species, as they were successively introduced on the earth. As a fact, repeated intro-

duction of new species has taken place from the earliest time at which living organisms first appeared, to the time that man came on the earth. Since his appearance we know not that any new organism has appeared. But it is claimed that sufficient time has not yet elapsed to allow this. Why not? What prohibits or limits the operations of the vital force after the appearance of living beings? Have we any knowledge of such prohibitions or limitations? If it be a physical force, living organisms should be as readily formed, and should be as common and abundant as are material bodies which have no limitations but physical conditions and atomic attraction. But as living organisms do not appear as readily and as commonly as material bodies, and that, too, when all the necessary and natural conditions are present, the reason of the fact may be presumed to lie in the specific difference there is between the vital and physical force.

Another fact is too prominent and important to be overlooked. During the vast periods that have elapsed since the earth became solid, and numerous chemical compounds appeared in their crystalline form, there has been no advance in structure in material bodies. Crystals were not less perfect in structure, or less complex when they were first formed, than they have been since, or are now. There is nothing surprising in this when we understand the invariability of physical laws, and the immutability of matter. The reverse of this is true as respects living organisms. The organic world is characterized by its system of graduated structures. They begin in the simplest and end in the most complex. Between the extremes lies a series of perfectly graded living organisms, the last wholly unlike the first, and widely removed from it by the complexity of the structure and numerous differentiations. This gradation as respects structure is so great, and the increasing complexity so wonderful and characteristic, that it would seem that we ought to regard the power that molded these numerous grades of structure from the dead elements of the inorganic world, and in these graduated structures presented to us a most beautiful system of living organisms, as one, in every conceivable particular, wholly and specifically different from the forces that could do no greater work with matter than mold it into beautiful, lifeless, and motionless crystals. A silicate of

lime or of iron, or any other base, is the same in whatever period of the earth's history it may have been formed. So with all other mineral salts. No improvement has appeared in their structure. No new properties, or organs, or functions have appeared in their crystalization. In the organic kingdom the reverse is true, and characteristic of the kingdom. Differentiation of structure and multiplicity of organs and functions are conspicuous and universal in the system of organized beings. It cannot be, then, that the force concerned in the formation of crystals, and the power that originated and differentiated living structures, are one and the same in nature and kind.

That crystals of the inorganic world are not the analogues of living organisms of the organic kingdom, is evident from another fact which obtains only in the latter department of nature. Modern scientists claim that the force of crystalization sustains the same relation to matter that the vital force does to organic matter and living organisms; that as the one gives us crystals of matter, the other gives us organisms of matter. Now if we find vital organisms exhibiting a function which is impossible with crystals, the conclusion can hardly be questioned that the forces concerned in the production of these two classes of bodies, are as distinct and different as their productions. It is one of the inherent and essential attributes of the living organism that it reproduces its like. The mode or process of this reproduction is more clearly seen in the lower forms of animal life than in the higher. In the former class reproduction takes place by fissation or division, after which each part becomes the exact counterpart of the original, in every particular a perfect representation of it. These parts in turn when fully developed are themselves divided, and this procedure, though obscured and modified in the higher organisms, obtains throughout the entire organic kingdom. There is no exception. Every living organism is designed to reproduce itself before it dies, and all when normally developed are fully capable of reproduction. This procedure is as familiar to the scientist as any phenomenon in nature. He regards it as the differential attribute of living organisms. Such a thing in the world of dead matter is unknown. The purest and most beautiful crystals present no such phenomenon. They never divide so that each part becomes the reproduction of the

original. Masses may grow in bulk by aggregation, and crystals divide by cleavage, but neither is this growth, nor this division a vital process. There is no movement or change of place between their particles of matter. There is no spontaneity in the cleavage of crystals, as in the division of living matter. When we shall see material bodies grow and divide, and the divided parts grow and divide, and each divided part ultimately attaining the form, size, and attributes of the original, it will then be time enough to affirm that there is no specific or categorical difference between crystals and living organisms, or between the physical and vital forces. The fact of reproduction places an impassable gulf between the organic and inorganic world, and positively forbids the supposition that living forms are but modified crystals, or the vital principle but a modified physical agent.—*St. Louis Med. and Surg. Journal.*

PRESERVATION OF TEETH BY THE USE OF CATGUT AFTER THE REMOVAL OF A DISEASED PULP.

BY C. SAUER.

Translated from the Deutsche Vierteljahrsschrift für Zahnheilkunde by G. A. CHRISTMAN.

Heretofore the preservation of teeth has been uncertain in those cases, where, preparatory to the filling of the tooth, the periosteum and pulp demanded treatment. If the pulp is merely exposed, or even if on account of inflammation it must be extracted, as long as this inflammation does not extend through the pointed pulp root, the preservation of the tooth is comparatively certain. In all other cases it is doubtful. I believe, however, that the number of preservable teeth is greatly increased by a careful treatment of all such cases as these with catgut; (gut strings peculiarly prepared, which Lister uses in his disinfecting

process, for sewing wounds and ligating vessels, and which is kept in carbolized oil.)

In the sixty cases which I have so far treated, there has not occurred a single failure. From January to the middle of June over forty-five cases were treated with success, and these I have followed up to the present time and will give a description of them in these pages.

The method of treatment heretofore practiced is, according to my opinion, by this method much developed and shortened, besides being rendered more successful.

A treatment which heretofore lasted for weeks or months can now be accomplished in two sittings, after the existing pain has been allayed.

I will now briefly present such cases as belong here, and also describe the manner in which they have generally been diagnosed and treated.

An exposed pulp, even when it is incised, always gives the greatest prospect of preservation. If it is not incised, after all foreign substances have been removed by syringing the cavity with tepid water, and cleansing it with carbolic acid, the tooth has merely to be filled as soon as the pulp is capped. As a rule this is done temporarily with os-artificial. In this way the pulp remains without any perceptible inflammation, and by a favorable course, is concealed behind a covering of dentine which nature forms for the protection of these delicate tissues. The same result almost invariably follows the incision of the pulp, and the treatment is the same. After the course of about six weeks it is generally permissible to substitute the temporary by a permanent filling. The first result of incision of the pulp is the formation of pus, which ultimately leads to extraction of the tooth.

Inflamed pulps that are rendered painful by cold applications, have, as a rule, heretotore resisted all attempts to restore them to health and have demanded extraction. But if they lay under a covering of dentine their destruction could not readily be accomplished by means of a cauterizing agent, and in such cases we were often compelled to extract the respective tooth. Now and then a strange circumstance enters into these cases where the pulp has been capped with os-artificial, viz: That a patient may

not be troubled for years with the diseased pulp, but if the protective capping be removed to insert the permanent filling the pulp will be found in its original painful condition. When the inflamed pulps have of necessity been extirpated, we rarely find by this extraction, that the inflammation has extended like a wedge, as far as the apex of the root. I would like to call particular attention to this phenomenon, because as soon as inflammation reaches the apex of the root, inflammation of the root-membrane immediately follows. If the inflamed pulp be destroyed with arsenic I am able in all cases, after extraction of the pulp, to point out the focus of inflammation in two or four places from the crown of the pulp to the apex of the root. If such foci of inflammation existed, in spite of long treatment of the root canal with carbolic acid, I have often observed the existence of inflammation in the investing membrane of the root; and in case of tumefaction of the jaw, have discovered an abscess emanating from the apex of the root. Notwithstanding all this trouble the tooth had to be extracted. Usually the same result followed extraction of a pulp which exhibited suppuration or gangrene, in spite of treatment for weeks and months with disinfecting agents; and likewise when the pulp canal was completely desolate. In all these cases there exists a chronic periostitis which has seldom ever been cured.

Should this develop into an acute condition and the pulp still remain—whether inflamed or suppurated—this condition of acute periostitis usually departs upon the extraction of the pulp or its remnants. In such acute inflammation of the periosteum, the periostitis likewise disappears if the pulp be cauterized with arsenic.

It is much more difficult to cure acute periostitis if the pulp has died away. In this case, just after the extraction of the pulp the pulp canal must be washed out with carbolic acid, if the sensitiveness of the tooth, in any way, will permit it. Sometimes the periostitis departs immediately after this manipulation, but if this be not the case, or, if on account of the sensitiveness of the tooth the canal connot be washed out, the periostitis often subsides by repeated applications of tincture of iodine to the gums, and by a subsequent application of moist heat. The iodine can be applied in those cases where no swelling is perceptible.

The treatment of a tooth with a pulp which shows various foci of inflammation or suppurative or gangrenous decomposition, or a tooth with a periostitis which has developed into acute inflammation, heretofore required a treatment of some weeks or months if it was to be filled. The therapeutics used in this instance are invariably only disinfecting and cleansing agents, and a very small proportion of these cases could be called successful, even after a comparatively long treatment. Generally the treatment failed for want of endurance on the part of the patient. As has heretofore been said, after the filling of the root canal, often after a long treatment, there appeared an abscess of the gum; sometimes immediately after the root canal was filled; again a month elapsed; and again perhaps years before it made its appearance.

It often happened, to our regret, that the filling material penetrated the apex of the root. It was certainly difficult to cure a periostitis originating from such a source, as the cause could only be detected after the extraction of the tooth. On the other hand, often flexions of the roots would not allow a perfect filling of the canal. The cases delineated here would seem to offer only failure as a reward for the best aims of the dentist. Many colleagues advocate the extraction of such a tooth; others, who use every possible endeavor to save these teeth, provided the risk be inconsiderable, prefer to bore into the root canal from the neck of the tooth just beneath the gum, immediately after the extraction of the pulp; this, though, only when the extirpated pulp shows various spots of inflammation on its surface, or strans of suppuration and decomposition to such an extent as not to warrant the filling of the root. In this way they prevent possibly a long treatment by supplying an exit for the pus, which would otherwise have formed an abscess. The preservation of the tooth, however, is by this treatment only insured to a limited extent. If the teeth to be treated have but one root, this method of procedure is generally followed by success, notwithstanding the continued secretions and the thereby decreased vitality of the tooth. This however cannot be said of teeth with more than one root, as more than one canal cannot be conveniently opened. These *tap.holes* can easily become obstructed, either through the drying up of the secretory products or through

lodging of foreign substances in their passage through the *tap-hole.*

Up to this time there has been a desire on the part of the whole profession, for a rapid and sure treatment of such "pulp canal" (or rather such a "periostes"), after the existing pain has ceased. For nearly a year past my attention has been directed to Lister's catgut, the resorptive capacities of which, on account of its disinfecting properties, are well known in surgery. Since last New Year's I have employed this substance in this direction in my practice. I had not intended to detail my success until the coming year, but as I found its efficiency unsurpassed, I prefer to embrace the present opportunity of making it known.

In setting forth the results of my observations I shall first speak of what is known of the behavior of catgut in relation to the organism, and how I think the catgut brought about the healing process, and with what symptoms it was always accompanied. Then I shall describe the manner in which I used it, and finally communicate some histories of cases.

By the use of catgut in surgery it has been observed that it has the property of being absorbed by the soft tissues. We may presume that it is absorbed in a similar manner by bone. This has been corroborated by the private researches of Dr. Redinger, of Wurzburg. This gentleman used catgut as a styptic in hemorrhage of bones. He forces a few pieces of catgut into the vessel until the lumen is filled up. After favorable results he investigated experimentally the effect catgut would have in the bone, and found that it was absorbed by this, just as by the soft tissues. I had become acquainted with this work of Dr. Redinger some months ago while I was using the catgut for our own purposes.

If the catgut is really driven through the apex of the root into the spongy structure of the bone, according to this, the inflammation that would follow would soon be reduced by the absorbing character of the catgut. Even this unfavorable condition cannot be of ill consequences, as one may rely upon the disinfecting property of the catgut to soon put things into a healthy state. It is wholly this disinfecting quality that helped me to success in the cases I have cited. The catgut with which

the root is filled, forms for a long time the constant carrier of the disinfecting medium (carbolized oil) which is thus gradually conveyed to the periosteum. This might act directly from the opening at the point of the root, but it is also possible that it is transmitted by absorption though the vessels which perforate the cementum and dentine to the canal near the apex.

Pursuing this theory, any other disinfecting agent would answer the same purpose, as soon as it could be stored in the root canal in considerable quantity without producing irritation. We might suggest thymol in the place of carbolic acid, but I would give the latter, dissolved in oil, the preference; first, because the composition is at hand, and besides the effect of catgut prepared with carbolized oil is such that no producer of caries can enter the root canal as it might, for instance, by the use of cotton. The catgut for itself deserves to be recommended for root fillings as it will do no harm if the root canal is penetrated, for it will be absorbed. In the same manner, carbolized oil may be recommended, owing its power of resorption to the fact that it contains oil.

This treatment with catgut accomplishes the same end as our previous methods of procedure, only it allows the disinfecting agents to remain in constant contact with the diseased periosteum without depriving the pulp canal of its stopping, an objectionable feature involved in the renewing of the carbolized cotton, as in the old method foreign substances existing in the cotton, or the atmosphere, often gained access to the root canal and excited suppuration. By the new method, on account of the constant stoppage of the carious cavity, the time is much shortened and better success is insured. Further, if we consider for a moment the probabilities of the case, we will see that formerly, when the filling material penetrated the root canal, the tooth had to be extracted, whereas now, the excess of catgut forced through the apex of the root is absorbed.

I have often seen that a slight periostitis followed this operation, though the patient was very rarely conscious of it. But if it existed it could, in all cases, be established by percussion.

* * * *

From January last, to the middle of June, I have treated forty-five cases, in almost all of which the pulp was either sup-

purative, gangrenous or dead. In most of these, as above stated a slight periostitis followed. Among these I have seen six in which the inflammation was increased to an insufferable degree, and in which a swelling had formed. In all these an abscess had previously existed. Of these cases five have been cured without return of the abscess, and although swelling set in it soon disappeared; only in one case, where a root was concerned that should have been supplied with a pivot tooth, an abscess followed this treatment. The neighboring root, which formerly had been attacked with abscess, developed a swelling under the treatment with catgut, but no abscess. In one experiment which, however, is not included in this enumeration, I extracted the tooth at the request of the patient, and found the lining membrane of the root somewhat inflamed—the catgut had not penetrated the apex.

A tooth with a diseased periosteum with no further treatment, exhibited, as a rule, two or three days after the filling of the root, the same sensations upon percussion as the sound teeth. This length of time was only greater when swelling existed. If at the beginning of a violent periostitis, and before the swelling began to rise, the gum was skillfully painted with iodine and moist heat applied, a time of from six to eight days was necessary to bring the tooth to its normal condition. All the cases that came under my observation, several months after the treatment (at least twenty in number), were in their normal condition. As for the rest of the cases I had an opportunity of seeing the patient from fourteen days to a month after the treatment. In an inflamed or suppurative pulp a swelling is least to be feared, for in these cases I have never seen swelling follow this treatment. If pain should follow this treatment I at once paint the gums with the tincture of iodine

When a diseased tooth comes under my care I do not, as heretofore practiced, treat it for a length of time after the symptoms of pulpitis or periostitis have disappeared, but immediately pass on to the filling of the root with catgut. As a matter of course, before filling with the catgut, the root canal must be cleansed as much as possible. The remains of the pulp must be removed with a nerve extractor and the canal washed out with carbolic acid. For this washing process I use a barbless nerve extractor

wrapped with cotton which has been dipped in carbolic acid and glycerine, as a washer. This wad of cotton is repeatedly changed until it comes out of the canal as clean as when introduced. When the canal has been thus far prepared I use Lister's catgut No. 2 for filling it. This catgut, of which there are various thicknesses, generally fits the lumen of the canal.

In a few cases I have used No. 0, but it is thin and consequently does not so readily follow the direction of the canal, for it very easily slips off from the conducting instrument. Before introducing the catgut I measure the length of the canal to be filled, with a nerve extractor. I then cut off a piece of catgut corresponding to the lumen of the canal, leaving it from one-third to one-fourth longer than the entire length. I take then a clean and polished (not serrated) pair of flat-nosed pliers and flatten one end of the piece I have cut off. This flattened end I trim to a point with the shears in order that it may fit the canal as closely as possible as far as the apex. Then I take this piece of catgut in a pair of pincers, dip its point into the carbolized oil and introduce it into the root canal as deep as I can, taking care that the canal is free from saliva. Then I force it finally down with a root plugger or watch-maker's broach. If the catgut cannot be introduced by means of the pincers in a straight line into the root canal, I force it down with a curved plugger, the excess being left in the pulp chamber. It is necessary, however, to make the opening in the crown, of such form as to allow the catgut to be started at least into the opening of the root canal with the pincers. After thus having filled the canal I insert a temporary filling in the crown. After this temporary filling has been in the mouth for a year or so, without recurrence of pain, I insert a permanent filling. When we are further advanced in this experiment, I have no doubt that we will insert the permanent filling at the same sitting that the catgut is used in the root.

I have adopted this plan of treatment especially in teeth and roots in which periostitis or a suppurative gangrenous or devitalized pulp existed. I am inclined to believe that every tooth and root can be filled where decay is not too far advanced, if the pain caused by a diseased pulp or inflamed periosteum can be subdued. The cases where it is impossible to stop the pain of a pulp or periosteum, I do not consider of a large number. In

teeth which on account of a cyst or fistula had to be extracted, I found a difference, but even in these cases an experiment with this method is justifiable. In making experiments upon such teeth, either of one or more roots, I have forced the catgut through the apex of the roots and success followed whether the teeth had just recovered from periostitis or not.

Of the forty-five cases already mentioned, I will only call attention to two of the most unfavorable, the one in its final results, the other in its first appearances. All of the others are substantially nothing more than the filling of roots under ordinary circumstances, with the exception that in place of using some other filling material, catgut was taken, and that after the inflammation of the pulp and periosteum had subsided, it was not considered necessary to wait for days, weeks and months before filling, but the root and crown were filled at the same sitting.

The most unfavorable case without question was the one first mentioned, which ended in the formation of an abscess. It was the root of a right superior lateral incisor, and was destined, as was also its neighbor to carry a pivot tooth. As the canals of both of these roots showed only gangrenous decomposed contents, and as the patient being asked informed me that he had been troubled with abscesses for several weeks I concluded to fill these roots with catgut and crown with pivot teeth. As considerable sensitiveness followed this treatment, I advised my patient to apply iodine and moist heat freely. After three days a swelling appeared in the gum over the roots of these teeth, and over one of them (the lateral incisor) an abscess was found, which emptied its contents through an opening on the labial surface. Both roots caused very severe pain. After a further lapse of three days, six days after the beginning of the treatment, the roots could be touched without pain, the lateral incisor, only, showing a slight sensitiveness. In about six other cases in which pivot teeth were adapted to the roots, everything was in a normal condition. Among these were a few which under the same circumstances as the above were restored to health. The second case referred to was, in spite of a very highly inflamed periosteum, with this treatment a success. A patient came to me with the intention of having his right inferior dens sapientia extracted, telling me that it had pained him for a

whole week, day and night. The tooth responded to the slightest touch of the tongue. To my proposal to try to preserve the tooth the patient willingly consented. I directed him to apply tincture of iodine to the gum on the buccal as well as the lingual surface, three times the first day; also to make a local application of moist heat for about three hours in the fore and afternoon, and to take a hot foot bath upon retiring. I took away as much as I could, of the disintegrated dentine, put a pellet of cotton saturated with carbolized iodine into the cavity, covering it with cotton dipped in sandarac varnish. The cavity was situated in the buccal surface, end extended under the gum. Moist heat was also made use of the following and third day. The fourth day the iodine was again applied three times, but as very little sensitiveness then existed in the tooth, moist heat was dispensed with. On the fifth day the tooth was wholly free from pain. An opening was now made by means of a burr on the buccal surface, large enough to enable me to reach the apices of the roots with a nerve broach As the roots did not contain any portion of the nerve tissue, they were cleansed with carbolized oil, the catgut at once introduced, and the crown cavity filled with os-artificial.

This patient, as were all others I have treated, was instructed to call again for examination, especially should any soreness manifest itself. Two weeks afterwards I examined this case and found on percussion that its condition was the same as the rest of the teeth.

In other similar cases I have had the oppertunity of convincing myself of the success of this method, after four month's time. According to my experince this method of treatment, seems to me, a step toward the preservation of the teeth no less important than was the application of arsenious acid to the pulp, as a cauterizing agent; and, in fact, it is an appendex to the latter, essential to the completion of the operations upon such teeth.

I hand this work over to the profession in the hope that it may be of much benefit to our patients, and with the promise to further describe and publish my future observations.

"ORAL ELECTRICITY."

Read before the St. Louis Dental Society.

BY JAMES W. WHIPPLE, D. D. S.

MR. PRESIDENT AND GENTLEMEN:

At the last meeting of the Society, some questions arose with regard to the chemistry of saliva and the effect of the electrical phenomena produced by the action of saliva upon different metals, in direct contact with each other in the teeth.

I have made a very hasty study of the subjects referred to, and now respectfully desire to bring before the Society the results of my investigation as embodied in this paper.

According to Brande and Taylor, saliva in an absolutely pure state is always more or less alkaline and never acid; the mixed fluids of the mouth deriving their acidity from the secretions of the mucous membrane of the oral cavity.

This acidity is not always present, being sometimes neutralized by the increased alkalinity of the saliva proper.

Miller and Gregory both say that the saliva is acid in certain inflammatory conditions.

In Harris, I find the following: "Dr. Bell says acid saliva is regarded by M. Donné as indicative of gastritis or deranged digestion. Mr. Laycock, on the other hand, infers from numerous experiments on hospital patients, that the saliva may be acid, alkaline or neutral, when the gastric phenomena are the same. In general, Mr. L. says that it is alkaline in the morning and acid in the evening."

Tomes gives Dr. Wright's analysis of healthy saliva as $\frac{988}{1000}$ water, and among other things $\frac{1}{2000}$ part as fatty acid; but, another item of $\frac{2}{1000}$ of mucus, shows that he experimented with the mixed fluid of the mouth, and I think it possible that Miller, Gregory, Bell, and Laycock may have done the same. At any rate I prefer to accept the statements of Brande and Taylor's chemistry, which is certainly reliable authority.

The tip of the tongue secreting as it does an acid mucus, and being submerged at all times in the fluids of the mouth, is more

plentifully supplied with acid than any other part of the oral organism.

From these data we may legitimately come to the following conclusions:

1st. In their normal condition the fluids of the mouth will not produce any very decided galvanic action, but they may do so in certain diseased conditions.

2nd. That the tip of the tongue, being more strongly acid than any other part, and being endowed with nerves of peculiar sensitiveness, will be most easily affected by the galvanic current.

When a tooth is filled with different metals, as for instance, a gold crown filling in contact with a proximal one of amalgam, and the tongue is applied to the part, a peculiar sulphury taste is noticed, and a slight galvanic effect or shock is felt. This condition may always be present, but to a much less extent when the fillings are covered only by the ordinary flow of saliva, if indeed at all.

Morgan says in his electro-physiology and therapeutics, that while a galvanic current is in operation there is noticed a peculiar odor resembling phosphorus, due to the formation of electrified oxygen or ozone.

The sulphury taste is due, in all probability, to the same cause, the evolution of ozone.

We have then, in the tooth, all the phenomena of a galvanic current, and may safely assume that it is present.

The question now arises, assuming all the conditions most favorable for a galvanic current, what will be the probable effect upon the tooth and fillings?

Beard and Rockwell say that electricity is a stimulating tonic, and that if long continued, it produces nervous irritation.

We know that galvanic currents are much used for the cure of various diseases. Galvanic belts are worn for weakness in the back. Galvanic soles are used to relieve cold feet, and galvanic appliances are now made to relieve headache, sleeplessness and many other forms of pain. So far as I am informed, even their long continued use is productive of no evil or unpleasant consequences. I can see, therefore, no evil results arising from its presence upon the tooth itself.

With regard to its effects upon the metals, Brande and Taylor

say, "At the point of entrance of an electric current, oxygen is evolved and at the point of exit, hydrogen." This agrees with Morgan's statement with regard to electrified oxygen or ozone.

Now, when the fillings are first inserted, and the acid fluid applied, there will be a galvanic current set in operation. The unpleasant taste will be noticed and the shock felt to a greater or less degree. Oxygen will be evolved from the surface of the amalgam filling at the point of contact with the gold; upon all other surfaces hydrogen will be given off. A gradual deposit of the silver, tin or zinc oxides will be made, and when this deposit is of sufficient thickness the current will gradually, and eventually, entirely cease.

This is in accordance with the experience of the dental profession, for, while at first the unpleasant taste is very strong, it becomes less and less noticeable until it can no longer be detected even by the delicate gustatory nerve, proving conclusively that the evolution of the electrified oxygen or ozone of Morgan has ceased. There can, therefore, no longer be a galvanic current in operation.

It has been asserted that the amalgam filling is disintegrated by the galvanic current, but I think this is an erroneous belief.

Morgan says that gold touched by silver or zinc, is positively electrified, and the silver and zinc negatively. I can see no good reason why one filling should be more effective than the other, unless it is a fact that negative electricity is more injurious in its effects than positive.

Of course the baser metals will be more readily oxidized, but I have already shown that the process of oxidization soon ceases entirely.

It strikes me that, as the more severe and violent galvanic effects are felt when the tongue is in contact with the fillings, and as the tongue apparently receives the entire galvanic shock, that it is the organ most liable to be injuriously affected.

From these facts I am led to the conclusion that the galvanic current induced does not permanently or materially affect either the fillings or the tooth, and that we must look in some other direction for the cause of some of our failures.

In some mouths gold fillings fail; in others, amalgam proves

utterly worthless; but I do not think that galvanism is the inducing cause of failure in either case.

In the discussion of the above paper, two points were raised, which, as they may occur to others, I will refer to in this connection:

Dr. Holmes spoke of a case where a large gold filling came in direct occlusion with one of amalgam in the lower jaw. The galvanic effect continued and he finally had to remove the amalgam filling.

In this case the continued attrition will prevent the accumulation of the oxides, and the removal of one of the fillings becomes a matter of necessity.

As my whole argument is based upon the accumulation of these oxides, this is not a valid objection to my conclusions.

Prof. Judd said that where the fillings were in close proximity to the nerve, the galvanic shock might, if sufficiently strong, cause death of that organ.

I believe that Bridgman, the originator of the dental electric theory also held this opinion, but I am compelled to doubt its correctness.

That a nerve will sometimes die under such circumstances, is undoubtedly true, but this will also happen when there is no appreciable galvanic current in operation.

It is, indeed, not an unusual thing for a nerve to die under any large metallic filling, but I think it is generally conceded that this is due to the effect of thermal changes.

If so in one case, why not in the other?

When it is shown that even the most violent and prolonged galvanic current will cause the death of a nerve in any other part of the body, I will most cheerfully modify my views to conform with proven scientific facts.

TRANSACTIONS OF THE MISSOURI AND KANSAS STATE DENTAL ASSOCIATIONS.

THIRTEENTH ANNUAL SESSION.

By W. H. EAMES, Secretary.

KANSAS CITY, June 5, 1877.

The Missouri State Dental Association convened for its thirteenth annual session in Odd Fellows' Hall, Kansas City, June 5, at 10 a. m., and was called to order by the president, Dr. G. A. Bowman, of St. Louis.

On motion, the calling of the roll was dispensed with.

The Secretary read the minutes of the last session.

Dr. S. B. Prevost presented the names of Dr. C. B. Hewitt, of Kansas City, and W. H. Buckley, of Kearney, for membership.

Referred to the Executive Committee.

Dr. Prevost requested to be excused from acting on the Executive Committee in the examintion of candidates, suggesting the name of Dr. Judd as a substitute. Request granted, and Dr. Judd appointed to fill vacancy. Dr. Tindall requested to be excused from the same duty. Request granted, and Dr. Wasson appointed to fill vacancy.

Dr. Eames moved that a committee, consisting of four members (two from each Association present), be appointed to arrange the order of business for the joint sessions. Carried.

Drs. Tindall and McCoy, of the Missouri State Association, and Drs. Wasson and Thompson, of the Kansas State Association, were named as the committee, to which Dr. Eames was added.

Dr. Eames moved that the hour of 8 a. m., of Thursday, be set for a session of the Missouri State Association for the transaction of such business of a legislative character as may come before it.

Dr. Eames presented the name of Dr. J. B. D. Worley for membership. Referred to the Executive Committee.

Executive Committee reported favorably on the names of

Drs. J. B. D. Worley, Clinton; W. H. Buckley, Kearney; C. B. Hewitt, Kansas City. Report accepted, and on ballot the gentlemen named were declared duly elected active members of the Association.

Adjourned to meet at 2 p. m., in joint session.

JOINT SESSION.

FIRST DAY—AFTERNOON.

The Missouri and Kansas State Dental Associations met in joint session at 2 p. m., and were called to order by Dr. Bowman, president of the Missouri State Association.

Dr. Bowman read his *annual address*, or as he more properly expressed it, "address of welcome."*

Committee on order of business reported as follows:

Morning sessions to open at 9 a. m., adjourn at 12:30 p. m.

Afternoon sessions to open at 2 p. m., adjourn at 5 p. m.

Night sessions to open at 8 p. m., adjourn at pleasure.

Clinics to be held in the afternoons of Wednesday and Thursday commencing at 2 p. m.

Report adopted.

Dr. Patterson, president of the Kansas Association, read his annual address.

Dr. Judd read a paper entitled, "A Contribution to the Study of the Dental Fissures."

Following the discussion of this paper, there being no other paper at hand, the subject of Operative Dentistry was taken up, Dr. Judd opening the subject.

Adjourned.

SECOND DAY—MORNING SESSION.

Missouri State Association called to order by President Bowman, at 8 a.m.

Minutes of the previous session read and approved.

Dr. Eames stated that the order of business as adopted by the Convention, if carried out, would interfere with the election of

* This paper, with others referred to in the transactions, have appeared in THE JOURNAL. The discussions will be published in succeeding numbers.

Trustees of the Missouri Dental College, which the Association had made the regular order of business at 4 p.m., of the second day of its annual session. In order not to interfere with the order as adopted, he moved that the election for Trustees be deferred and made the first order of business on Thursday. Carried.

The Executive Committee reported the names of the following gentlemen as operators at clinics at 2 p.m.: Drs. Judd, Wheeler, McCoy, Bowman and Hewitt. Adjourned.

JOINT SESSION.

SECOND DAY—MORNING.

Convention called to order by Dr. Patterson, of the Kansas Association.

Dr. Bowman read a communication from Dr. B. L. Spencer, as follows:

Dr. ———, of Platt City, aged about forty years, is of a nervous, sanguine temperament. Has had more or less trouble with his teeth from his youth, some of them troubling him to the extent of producing alveolar abscess. About one year ago a portion of the alveoli became necrosed, commencing at the medium line and extending back as far as the first superior bicuspid, necessitating the removal of the necrosed portion. After the removal, all inflammation seemingly subsided, absorption going on slowly. For some time past there has been a peculiar hard, bony formation growing in the center of the palate and recently a fistulous opening has appeared on the left palate bone, opposite the first bicuspid. In the center of this fistulous opening there is a peculiar hard, bony substance, resembling a tooth. But in exploring the parts involved I find the periosteum detached from the palate as far back as one-fourth inch, and nothing to justify me in concluding that it is a supernumerary tooth, I confess my inability to form a satisfactory diagnosis. The most reasonable conclusion I can arrive at is, that it is exostoses of the palate bones, but from what cause I am unable to say. Please present the case before the Associations and get an expression of opinion regarding it.

Dr. Prevost presented a case of Salivary Calculus.

Dr. Thompson read a paper entitled "Conservation of Pulpless Teeth." Adjourned.

JOINT SESSION.

SECOND DAY—NIGHT.

Convention called to order by Dr Bowman, at 8p .m.

The subject of Dr. Thompson's paper was taken up for discussion.

Dr. Shulzer gave the details of several cases which had been presented to him for treatment of teeth abscessed. Discussion of these cases followed.

A paper on "Dental Alloys," by Dr. H. S. Chase, was read by Dr. Price. Adjourned.

JOINT SESSION.

THIRD DAY—MORNING.

Convention called to order by Dr. Bowman, at 9 a.m.

Dr. Wasson read a paper entitled "Pulp Capping."

Dr. Eames, Dean of the Missouri Dental College, made his annual report, followed by a paper by J. Campbell, on "Dental Education."

On motion of Dr. Morrison, the Trustees of the College were instructed to extend the term of instruction to three years as soon as practicable, and to make such other changes in the curriculum as they might deem necessary to place the Missouri Dental College in the front rank as an educator.

Adjourned to 8 a.m.

THIRD DAY—MORNING SESSION.

The Missouri State Dental Association met pursuant to adjournment at 8 a.m.

Dr. Bowman, President, in the Chair.

Minutes of the last session read and approved.

Drs. A. J. Prosser, Drury J. McMillen and Alfred Reed were duly elected members of the Association.

Drs. J. C. McCoy, J. B. D. Worley, J. K. Stark, G. W. Tindall, S. B. Prevost, and L. C. Wasson were appointed delegates

to represent the Association at the next meeting of the American Dental Convention.

The Secretary was instructed to fill out certificates to them and such others as might desire to attend.

On motion, a Committee consisting of Drs. Judd, Prevost and Stark were appointed to draft suitable testimonials of respect to the memory of Drs. Isaac Comestock and F. D. Fellows.

The Association went into an election of Trustees to fill vacancies occurring in the Board of Trustees of the Missouri Dental College.

Drs. Judd, Price and Forbes, whose terms expired at this time, were re-elected, and Dr. Henry Fisher* was elected to fill the vacancy occurring by the expired term of Dr. H. E. Gregory.

The next order of business being the election of officers to serve the ensuing year, the Association went into an election for this purpose.

On ballot for President, Dr. G. W. Tindall was declared elected. First Vice President, Dr. W. N. Morrison; Second Vice President, J. C. McCoy; Corresponding Secretary, H. Judd; Treasurer, J. A. Price.

On motion of Dr. Judd, the regular order of business, the election of the Executive Committee, was deferred till after the selection of the next place of meeting.

On ballot for the place of holding the next annual meeting, Sweet Springs having received the greatest number of votes was declared the choice of the Association.

The election of the Executive Committee being now in order, ballot was had which resulted in the election of Drs. H. E. Depp, J. C. McCoy and Homer Judd as the Committee, to which, on motion, the Secretary, Dr. Eames, was added.

On motion, the President was instructed to name the clinical operators for next meeting.

On motion the Executive Committee was instructed to report topics for discussion at next meeting and names of members as essayists.

The installation of officers was made the first order of business at the morning session of Friday.

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* Dr. Fisher's resignation has been received and accepted by the Board of Trustees.

On motion of Dr. Price, the Executive Committee was instructed to take into consideration the conduct of the Missouri Dental Journal and to wait upon the proprietors of the same, and urge the necessity of some change in the editorial management.

Adjourned to Friday 8 a. m.

W. H. EAMES, Secretary.

[To be concluded next month.]

Journalistic.

The *St. Louis Medical and Surgical Journal* comes to us much enlarged, in an entirely new dress, with new editor and publishers and presents altogether a very creditable appearance. Its pages are filled with able and interesting articles, scientific and practical, and if kept up to the standard of the January number the *St. Louis Medical Journal* will take a high position in the current medical literatum of the day. We wish Dr. Rumbold, the editor and proprietor, success in his new undertaking.

The *Cosmos* for December has an article from J. Truman, D.D.S., which was read before the American Dental Society, of Europe, at its late session at Interlaken, Switzerland, upon "Theories and Practice concerning the Preservation of Immature Permanent Teeth." He commences by saying, "when Spooner declared, in 1830, that a pulp could be destroyed without the use of the actual cautery, the first glimmerings of real progress began in the treatment of teeth." He thinks that we do not specially require *practical* instruction so much as a clearer appreciation of theories. He says, "that most truly empirical assersion, which for so many years held sway over the minds of dentists, 'that any tooth that could be filled at all, could be filled with gold,' has no longer the slightest glimmer of truth in it." Thinks every case should be studied by itself, and no one filling universally adopted. Believes

that the teeth of this generation in America are better than they were in any preceding generation. He thinks that in building up teeth by nature, a constant development goes on till perfect calcification is accomplished and vitality ceases. If calcification once begins it ordinarily continues through life. If it should be completed at any period before its expiration, the tooth becomes a foreign body." At any rate progressive calcification does take place. At an early age, not only is the pulp larger than it will be when the teeth are matured, but the dentinal tubuli are also larger, the dentine is chalky, or exceedingly sensitive, and in a word, these teeth are defective as to their structure, and consequently our practice must be modified by these facts. "Under all circumstances a blind adherence to gold is a fault that amounts almost to criminality." He thinks in these illy developed teeth that any undue irritations upon these large dentinal fibres may cause their destruction, and that they may become a source of irritation to the pulp, which may in this way be destroyed. To prevent this would fill front teeth with Hill's stopping until the development has been perfected, and in back teeth would use tin. Objects to oxy-chloride on account of its irritating qualities though this may be used in immature teeth if the walls of cavity are first coated with a solution of gutta percha in chloroform.

In the report of the October meeting of the New York Odontological Society is found a paper by Dr. J. W. Clowes, of New York, which brought out a rather spicy debate. The author of this paper recommends, with a great flourish of trumpets, a method of applying arsenic for devitalizing pulps of teeth, which he claims as new, and which he would make us believe was a *step in advance* when compared with the old method. He drills a hole into the crown of the tooth nearly down to the pulp, and puts the arsenic in the hole and stops it in with dry cotton, and lets it stay for a week. This is for safety, as he declares that in nine cases out of ten, where this is not done, the arsenic gets on the gum and Alveolar Process, and does great damage.

The paper also condemns in strong language, the use of wedging, and advocates the practice of cutting away the teeth freely in proximal decay. Dr. Rich in discussing the paper said:

I have used arsenic for devitalizing the pulps of teeth ever since the time when Dr. Spooner suggested its employment for

that purpose, and in all the years that have intervened since that time, I have not seen a single case where such results have been produced by its application as those described by Dr. Clowes. I believe that all those whom we are willing to regard as our professional brethren have such an appreciation of the responsibilities of their position that, when they find it necessary to use so dangerous a substance as arsenic about the mouth, they will use all the care and precaution possible that no untoward results follow its application. In cavities of the character more particularly described by Dr. Clowes, where the edge extends down to or below the gum, that part of the cavity so situated can be prepared and filled with any of the plastic substances generally used for temporary fillings before the arsenic is introduced, and that part of the filling so arranged that, when the arsenic is applied and the rest of the cavity closed up, no portion of this dangerous material can escape. This simple method of preventing accidents in the use of this substance does not require any but the most ordinary manipulatory skill.

Ordinarily, arsenic is employed as the most speedy means known for destroying the vitality of an exposed inflamed pulp, and thereby relieving the patient from the existing pain. For the purpose of the immediate relief of pain, arsenic applied in Dr. Clowes' "Safety Pocket" would not answer at all; it might be weeks before it would reach and act upon the pulp. It is not a new method of applying this material; I used it in that manner many years ago, and the first case, in which it was an experiment, I will now describe. The right inferior cuspid in the mouth of one of my adult patients was so situated as to produce a very unsightly deformity. To remedy this it was necessary to remove that tooth. But this was not so easily done, as the crown was completely surrounded on all but the front side by the adjoining teeth, so that it could not be grasped by an extracting instrument. In this dilemma, I concluded to cut off the crown by boring a line of holes close together through it, near the gum from the front side, and then extract the root with the screw; these holes could not be bored until the pulp was devitalized, and as the tooth was perfectly sound, I concluded to try and devitalize the pulp by introducing arsenic in the substance of the dentine; for that purpose I bored a hole in the crown and placed a small portion of arsenic in it, and sealed it up with mastic cement. It was over three weeks before there was any evidence that the arsenic was acting upon the pulp; it finally destroyed it, and I was enabled to execute my plan for removing the crown and extracting the root. In regard to bad results following the use of arsenic in the mouth by dentists, I do not remember in the whole course of my professional life meeting with more than three or four cases where arsenic had been applied to the teeth in a careless man-

ner. One of these occurred within the past twelve months, and was remarkable from the liberal manner in which this deadly substance was used. The patient, a lady, upon being attacked by toothache, had gone to the dentist who usually attended to her teeth. He was engaged with another patient whom he could not leave, so he placed her in the hands of one of his assistants who examined her tooth, put something into it without informing her what it was, or giving her any directions in regard to it, dismissed her with the remark that she had better call again in about a week. As the application he had made did not relieve her, she called upon me the next day, and when I removed the temporary filling the dentist had placed over the substance he had put in, I was surprised to find the whole of quite a large cavity filled with dry arsenic, with a little cotton placed over it. I removed from that cavity almost enough arsenic to half fill a lady's small thimble; fortunately for the patient the cavity had been tightly closed. The examination of the tooth proved the incompetency of the dentist, for the toothache had not been caused by an inflamed pulp, as that organ had lost its vitality some time previous, was very far gone in decomposition and in a semi-fluid condition. But I apprehend that cases like the one just described are not often met with, and never occur in the practice of reputable dentists, who, as far as my observation extends, use this dangerous material with all the care that is necessary, and it cannot be for them that the implied rebuke contained in Dr. Clowes's paper is intended. Now who are the culprits, and are they of a class that we have anything in common with? I do not think that they are, nor is our business to endeavor to find preventives against their misdeeds.

Dr. W. H. Dwinelle said:

I rise to indorse the remarks made by Drs. Rich and Allen. I have been in practice more than thirty-eight years, and have used arsenic constantly ever since my initiation into the profession. I don't think it is any boast—it ought not to be boasting for a man who has his eyes and ears about him—it is not boasting to say he has used arsenic all his lifetime and never met with such an accident as referred to by Dr. Clowes. I could have had trouble with every application I made of arsenic if I chose to; if I were careless in applying arsenic in a cavity, especially if its wall was broken down so that the borders of the gum were encroaching within the cavity, I could have any amount of trouble. Of course every case does not present itself to us alike. I might say that no two cases present themselves to us alike. They all need different modification. We don't make all our shoes on one last. There is a never ending variety of cases requiring a continual invention with us from morning till night. We belong to the "noble army of inventors," and in our practice we illustrate the

principle that "necessity is the mother of invention." We are constantly finding ourselves in corners from which we have to invent ourselves out. We could all be unsuccessful if we were not actuated by the highest principle, and by the greatest care and effort to attain to the highest perfection. For instance, I have had a regulating case within a week, wherein I desired to save a sixth-year molar. Its lingual wall was broken down, and I wished to save it for a purpose. The nerve was not only exposed, but had grown into fungus that filled the entire cavity of the tooth, and, from the lingual wall being broken down, even below the gum, came in contact with the tongue itself. I destroyed the fungus mostly with caustic potash, and sealed up the cavity. The next day I cleaned it out, and built up such a wall as described by Dr. Rich, not of gutta-percha, but of osteo-plastic. I first put in a core of soft wax in the central part of the tooth, covering the exposed nerve. I then built up the entire lingual wall with osteo-plastic. On softening and removing the wax, the nerve, in its fungoid form, was perceptible at the bottom of the well. I applied arsenic paste to this, and sealed it up with more osteo-plastic. Forty-eight hours afterward I cut away this last portion of osteo-plastic, and removed the nerve from its canals. These I filled with gold, and afterwards completed the crown with osteo-plastic, as I wished to keap it for a year or two. Here was a case as extraordinary as any that can well be imagined, and I had no apprehension of any leakage or trouble. It is ridiculous to assume that trouble is necessary under such or any circumstances. If proper care and skill are used, such culpable and disgraceful results as Dr. Clowes refers to, will never occur. I think our friend gets into a "*rut*" himself occasionally. He has had his rutting season to-night; very naturally they seem to come over him periodically. About a year ago he had an unfortunate attack, when he declared that dentists did more harm than good. I think he falls into a rut in this matter when he puts the stamp of dishonor on our calling by virtually declaring that our noble profession was a failure, and all of its members were impostors. It is time we should repudiate such infamous, if not traitorous, doctrine, and defend our dignified calling, unsurpassed in its blessings, its charities and usefulness, from all such attacks, whether they proceed from within or without our ranks. Dr. Clowses' method of reasoning is, in some respects, unfortunately a very common one here amid our deliberations, and has much to do in retarding, rather than advancing, our progress as professional men. It is the everlasting arraying the negative against the positive; arraying failure against success; what has *not* been done against what has been done; the unskillful against the skillful; poor work against the best; a general array of negative testimony before you, to disprove and annihilate established

facts, as though it were possible to tear down truth from her high position, to stultify progress, and to destroy our hopes of the future. To utter the whining cry of "*woe*" in our midst, to disparage and to discourage. All this should be rebuked and put down whenever and wherever it manifests itself among us in our representative capacity. We are the custodians of the honor of our profession, and should look with jealous eyes, and be actuated by earnest, honest, and determined hearts, to the greatest ultimatum of our sacred trust. Our friend must have been very unfortunate in his experience. I think I can speak for everyone here, and say that this has been an isolated experience. It looks like the experience of the unskillful, the charlatan, and the quack, rather than that of the average practitioner. I have seen cases where people have been poisoned by arsenic. I cannot persuade myself that Dr. Clowes is correct in stating that he meets with arsenic poisoning in nine cases out of ten. It may be so in his practice, as intimated by Dr. Hill, or in the practice of the parties whose patients have fallen into his hands, but I do not believe it is true of any other respectable practitioner. He has made the statement that dentists are doing more harm than good. I think he ought to verify such statements with facts and confer with other brethren on the subject before he makes such assertions, so damaging and disgraceful to us as a profession.

The *Pharmacist* for December, in an article upon Antiseptics, says: "Sulphurous acid is a substance of great antiseptic power." Most conclusive observations of this may be found in No. 6 of a series of reports of the medical officer of the Privy Council, where Dr. Baxter shows that sulphur deoxide has a marked superiority over chlorine and carbolic acid in its power of rendering vaccine virus absolutely inert, and this under conditions which seem above all others to render the virulent particles less susceptible to destructive influences. "Dr. Sansom confirms these experiments, and further shows that sulphurous acid possesses properties both as a disinfectant of virulent liquids and as an ærial disinfectant far above its most powerful rivals."

We have noticed that in nearly all of the articles published of late in the journals upon this subject, no mention is made of the labors of Polli in this direction. Polli's great work upon disinfectants, published some twelve or fifteen years ago at Milan, contained not only an account of his own experiments with sulphurous acid, but also corroborating statements from a large number of the most prominent practitioners in Italy, and was

the first extensive treatise upon this subject which has been given to the scientific world and it seems that it would be no more than right to give him the credit for which is surely his due. Again we copy from the *Pharmacist's* article as follows :

Schönbein stated "that oil of turpentine can generate peroxide of hydrogen." In vol. iii. of Miller's "Chemistry," it is stated, "Oil of turpentine gradually absorbs oxygen from the air, with formation of a certain proportion of ozone;" and in "Gmelin," vol. xiv., it is stated, "Oil of turpentine absorbs oxygen gas, acquiring new properties, and being converted into ozonized oil of turpentine."

Although Schöbein's statements and peculiar views have received much support, there has ever existed more or less doubt about the formation of ozone by the oxidation of such bodies as turpentine. In the view of acquiring some certain knowledge on this point, Mr. Kingzett made a series of experiments (which have been published from time to time in the scientific journals) with the following results : At the commencement of the investigation it was taken for granted that the terpenes produce, on exposure to the air, an agent resembling ozone on the one hand and peroxide of hyrogen the other hand, but the exact nature was unknown. In his first paper Mr. Kingzett showed that it was not ozone, and that peroxide of hydrogen was not formed directly, but that in the case of turpentine an organic peroxide was first produced, which was afterwards decomposed by water and yielded peroxide of hydrogen. In his second paper he established the exact conditions under which it was formed He further isolated and analysed the decomposition products given by water, and prepared considerable quantities—amongst them were camphoric acid and peroxide of hydrogen. In his third paper he showed that a number of terpenes produced similar results when similarly treated, and explained why the crude oils containing them gave these reactions. Further, he determined the nature of the exact radical in these various terpenes and oils, the presence of which is essential to the formation of peroxide of hydrogen; this radical is cymene ($C_{10}H_{14}$). Having done this, large quantities of peroxide of hydrogen in aqueous solution and accompanied by camphoric acid and other bodies were prepared, by blowing air through a mechanical mixture of turpentine and water at 40° C., determining at all stages of the oxidation the varying conditions and results, and proving that the said aqueous solution possessed unqualified powers for disinfecting and antiseptic purposes. This liquid has been patented under the name of "Sanitas."

"Sanitas," therefore, is an aqueous solution of the oxidation products of turpentine, comprising peroxide of hydrogen, cam-

phoric acid, camphoric peroxide, camphor, etc. If you have read a very able pamphlet issued as an advertisement for this substance, you will have noticed the results of experiments with it. Peroxide of hydrogen only and camphoric acid only do not produce such satisfactory results as when the two are combined. Camphoric acid is stated to have all the properties of salicylic acid, to which it is chemically allied. We have in "Sanitas" the first instance on record in which a natural process of atmospheric purification has been imitated to perfection; in fact, on a commercial scale we could now repeat that which in pine and eucalyptus forests constitutes one of the most efficacious processes of nature's hygiene.

The *Register* opens with an address before the Michigan State Dental Society, which treats of some of the questions which are recognized as the living issues of the day, such as the propriety of dividing the operative and mechanical departments of the profession, arguing in favor of the division; gives a flattering account of the Ann Arbor School, which is a high compliment to the Michigan Legislature, which has treated the School with liberality, and we are pleased to see the prospects of the School so flattering. Prof. Watling, of the Michigan School, also read a paper at the same meeting upon the Physiology and Treatment of the Dental Pulp. He thinks forty-nine out of fifty exposed pulps can be saved alive. Recommends covering the pulp with a small piece of silk court plaster and then oxychloride of zinc; repudiates the lacto-phosphate of lime treatment as recommended by Dr. Cravens.

In the *Pacific Medical and Surgical Journal* G. B. Simmons, M. D., reports the removal of a spleen for hypertrophy of that organ. The case terminated fatally a few hours after the operation. Twenty cases of splenotomy are reported in our works on surgery, some of them more than three hundred years ago, with but *three* favorable results. J.

AMERICAN DENTISTS IN PARIS.

Drs. E. A. Bogue, New York; G. T. Moffatt, Boston; C. D. Cook, Brooklyn; G. C. Daboll, Buffalo, announce the opening of a dental office at 39 Boulevard Haussmann, Paris. May success attend them. E.

Editorial.

MISSOURI DENTAL JOURNAL.

This number commences the 10th volume of the JOURNAL, and we are in hopes that it will be found at the end of the year that its influence has been for the best interests of the profession. With our enlarged facilities we hope that we shall make it worthy of an enlarged circulation, and if we succeed in making it worthy of the confidence and support of our professional brethren we doubt not but that its merits will be cheerfully acknowledged. We have received many cheering letters from subscribers during the last six months, and although THE JOURNAL as it is now conducted, will not suffice to please some few who sometimes read a journal, still we believe that our course is fully sustained by a large majority of those who habitually read the current dental literature and profit by what they read. THE MISSOURI JOURNAL has extended its circulation until now it reaches nearly every land where civilization has extended its benign influences, and carries, every month, to all of the principal cities of Europe and of this country, the thoughts, opinions and experiences of those who contribute to its pages.

We ask, on the one hand, our contributors to write carefully whatever contributions they may send us for publication, remembering that they are writing for London, Berlin, Paris, Milan, Copenhagen, Rio Janeiro, Lima and Honolulu, as well as for St. Louis, New York, Boston, Philadelphia, New Orleans, Chicago, Cincinnati and San Francisco; and on the other hand, we ask our subscribers to not only read carefully, but study thoroughly all of the scientific and practical articles which appear each month in the pages of THE JOURNAL, and at the end of the year, we will guarantee to such, a pretty thorough knowledge of all improvements in dentistry, and in all branches of medicine which have any direct bearing upon dental theories or practice.

Let us all make 1878 a year of study and of thoughtful investigation, and if we improve to the utmost our opportunities, 1879 will assuredly find us occupying an advanced position whencom-

pared with the one upon which we now stand. We would say to all who may be stimulated to enter anew upon this progressive work, that it is best to begin *to-day*. What you may acquire to-day will be valuable, but what you acquire *to-morrow* will, in all probability, be of little service to anyone. The man who does his work *to-day* usually gets along in the world much better than he who does it *to-morrow*. Take care that your whole duty be done *to-day*, and let to-morrow take care of itself. J.

IN MEMORIAM.

At a meeting of the St. Louis Dental Society, held January 8th, 1878, at the office of Dr. H. Judd, subjoined resolutions were passed upon the death of Dr. C. W. Rivers, a member of the society, who died at Atlanta, Georgia, Nov. 15, 1877, aged 49 years:

"Upon the death of our esteemed and much respected confrére, Dr. C. W. Rivers, it becomes us, as a professional body with which he was for several years so honorably and devotedly associated, to give expression to the deep regret we feel in his loss, the sympathy we have for his friends afflicted like ourselves by his death, and the remembrances we cherish of a life devoted to its highest aims. Nor can we refrain from expressing our appreciation of his upright and moral conduct, his unswerving and constant devotion to his Maker, and his exceptionally kind treatment of all who were fortunate enough to be classed in his extended number of friends.

In consideration of his unusual and marked worth and his assistance in the cause of his life's work, his contributions to the profession of which he was a member and the respect he claimed from all who met him, Therefore be it

Resolved, That we tender to the bereaved family our sympathies in this their great affliction,

Resolved, That a copy of these resolutions be spread on the records of the society, and a copy be sent to the family of the deceased.

W. H. EAMES,
H. JUDD,
W. N. MORRISON

ODONTOLOGICAL SOCIETY, N. Y.

We are indebted to Dr. E. A. Bogue for an extended report of the discussions of the Odontological Society, at its last meeting, which we received too late for publication in the present number of The Journal. It contains several items of special interest to the profession which will receive attention in our next issue. Several notes and queries have also been crowded out of this number.

ST. LOUIS DENTAL SOCIETY.

At the annual meeting of the St. Louis Dental Society, held at the office of Dr. Judd on Tuesday, January 8, 1878, the following were elected officers for the ensuing year: Dr. A. H. Fuller, President; Dr. J. Ward Hall, Vice President; Dr. H. Judd, Corresponding Secretary; Dr. N. C. Stark, Recording Secretary; Dr. G. A. Bowman, Treasurer.

Books and Pamphlets Received.

Transactions of the Twenty-Second Annual Session of the Michigan Dental Association, held at Ann Arbor, October 9, 1877. Ransom & Randolph, Toledo, O.

This is a neat pamphlet of ninety pages, containing, besides the minutes, essays and discussions of the meeting, the constitution and by-laws, code of ethics, and list of membership of the Association, also a list of the dentists of the State of Michigan. This is the first publication of this character emanating from this Association. It is in every way a creditable showing, which will well repay perusal. E.

Transactions of the American Dental Association. Seventeenth Annual Session, held at Chicago, August 7, 1877. C. Stoddard Smith, Elgin, Ills.

This volume was received too late for a review in our present

issue. It is equal in appearance and size to former issues, and from the well known ability and painstaking character of the members of the publishing committee, we may feel confident that this will be found a true and faithful report, reflecting deserved credit upon the Association and those who had the work in charge. E.

Scraps, Notes and Queries.

THE biggest fool in the world is the *scientific* fool, who, being unable to understand the true relation of things, is always being led astray by imaginary logical sequences which exist only in his own feeble intellect, without dependence of any kind upon what he supposes to be their true antecedent or legitimate premises.

IN excavating a cavity preparatory to filling it, if you find the pulp dead, and the surrounding parts of the mouth in a healthy condition, how would you proceed to treat such a case?

WILL gutta percha allay sensitive dentine, and how long should it remain in the cavity? I have tried the various preparations in the market but with ill-success. D. D. E.

MAKING PLASTER CASTS.—There are two little points which require special care in casting plaster of Paris; one is greasing the article to be moulded, and the other is stirring up the gypsum with water. For the first purpose it does not require a penetrating fat, but one that remains on the surface and covers it. In making the paste, water must not be poured upon the plaster of Paris, but the latter must be strewn in as loose condition as possible upon the water until the plaster reaches the surface of the water, and then quickly stirred together. The substance employed to oil the moulds is prepared by adding some fatty oil, generally lamp oil, to a solution of soap in water; this is called "smear."

THE MISSOURI

DENTAL JOURNAL,

A MONTHLY RECORD OF THE SCIENCE.

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TEMPERAMENTS.

BY ELY VAN DE WARKER, M. D.

Every adult human being carries about with him an atmosphere of individuality. By this means is the gregarious animal called man, enabled to preserve in himself such an isolation from the mass of his fellows that he can gain and hold whatever may be his share of prosperity and remembrance. In this individuality lie his powers of offense and defense—the buckler and spear of his *ego;* and in it also is expressed the sum of his mental and physical traits in such a manner that, once having known, we may remember him. There are two elements that enter into the formation of this distinctive and memorable quality, mental and physical. These factors enter unequally into the formation of his individual total. The element that has really the least to do with that subtile force called character is the one by which we chiefly recognize the man. This is the *ensembled physique*, the mental picture we have formed of the bodily man; it is only by long association that we come to speak of one by his mental traits, and can recall him to our minds, not by accidents of size, shape, complexion, but by the tone, manner, and quality, of the mental man. It is curious, however, to reflect

that our chief means of mutual identity are the same as those by which we distinguish horse from horse, and dog from dog; and that such is the infinite variety in the merely physical development of men, that this is sufficient for the practical affairs of life. In fact, it is not within experience that two human beings ever existed who were so nearly alike that side by side they could not be distinguished.[1] But human individuality is separated from the brute by the refinement of a physical quality. This is called temperament. Although temperaments are purely of physical origin, yet their outlet is mainly found in the actions or the mental habits of the individual, and thus it is that temperaments, like charity, cover a multitude of sins. Even those who believe in the immateriality and separate entity of mind, do not hesitate to ascribe the fretfulness, fickleness, temper, and other mental shortcomings of their friends, to faults of temperament. This may in a measure be the result of habit, but I believe that there is about it the force of a truth that even the most spiritual of psychologists cannot escape. It exists as a physical medium, through which the mental life shines forth, tinged and refracted by its passage. The old word expresses it, *humors* of the body, a mythical, potent, and subtile fluid, mingling with the bodily substance, and rising, exhalation-like, into the brain, obscuring, revealing, exalting, and depressing the operations of the mind according as it is acting well or ill; as hypothetical as the interplanetary ether, yet as real as a fit of the blue devils. This was somewhat the old notion, and a well-fought battle-ground it was, over which the solidists and humoralists contended right gallantly. A standpoint upon a solid basis of fact is to this day wanting from which we may say they were wrong.

Many of these old fathers in medicine fairly reveled in the idea of temperaments. It contained just enough of the mysterious to spur on their wonder-loving minds. All there was of fact about it, however, they brought out, and all that we know about it they knew. We are to this day using their terms and classification, and have added nothing to them. It stands as a fact in

1. There are several remarkable cases of wonderfully close resemblance and mistaken identity on record, but none that stood the test indicated in the text.

physiology which we have inherited from the remotest boundary of historical medicine.

The four qualities of Hippocrates were believed to be the origin of the temperaments. In moisture and dryness, in heat and cold, not as conditions of existence but as entities in life, were found the materials that either singly or together formed the temperaments. They were combined thus: hot and moist produced blood, hence the sanguine temperaments; cold and moist caused phlegm or pituita, and from this phlegmatic or lymphatic; hot and dry produced yellow bile, and gave us the sanguine or choleric; and cold and dry caused black bile, which predominating in the body resulted in the melancholic or bilious temperament.[1] In order to understand the profound reason involved in this it must be remembered that these four primary principles of living bodies were believed to be compounded of the simple elements of Nature. Here is shadowed, dimly it is true, but from the very depths of Nature, the theory of the correlation of forces, and even evolution itself. Boerhaave was among the first who attempted to improve the classification of Hippocrates, and then followed Hoffmann, Cullen, and Haller, who, however much reason they may have had, failed to refine the rugged simplicity of the old Greek. Absurd as we may deem the incarnation of the four elements in the form of temperaments by Hippocrates to be, yet from the length of time this idea has prevailed, and the profound influence it has exerted upon science for centuries, we may believe that it possessed the soul of truth that exists in things erroneous, as Herbert Spencer says. Not until 1757 was anything like a scientific explanation given. The learned Haller was the first to give the four elements their final overthrow, and place the phenomena upon a physiological basis;[2] and even he failed to suggest any improvement in the old nomenclature. It is strong evidence of the force that exists latently in old ideas that all modern attempts to extend the scope of the Hippocratic terms have never gained credit. Dr. Gregory renamed the temperaments, and added a fifth, which he called the nervous, and which has been accepted

1. "De Natura Hominis," tom. ii., ed. Kühn.

2. "Elementa Physiologiæ Corporis Humani," 1757.

and rejected a score of times; while it is a convenient term to use, it is true that it describes no temperament that may not be included under the old terms. Then came Dr. Pritchord, who rejected the reforms of Dr. Gregory, restored the original terms, and barely escaped calling his predecessor hard names. But the temperaments, simple as they may seem, have afforded groundwork for a separate science—not formulated deductions from dry facts, but drawn warm from the mass of living, suffering humanity. Dr. W. B. Powell spent forty years of his life in the study, and at last evolved a "human science" with ten compounds of temperaments with binary, tenary, and quaternary subdivisions.[3] If human science, as taught by Dr. Powell, be true, it ought to be the ceaseless study of every man and woman, taught along with the creed and catechism—which are the spiritual to this its earthly and carnate part—to the youngest child. Lurking in this science are more than Dantesque horrors, which are liable to spring upon the most circumspect of us in the shape of physiological incest; as if in the decalogue and through the ingenuity of man there were not altogether more crimes than human nature can withstand, that we should be exposed to others we know not of. This physiological crime consists in the marital union of like temperaments. Human science has revealed another latent offense, called sexual incompatibility, which, so far as I know, has not yet, in its sexual guise, obtruded itself in the divorce courts. It is a standing rebuke to those who build imaginary sciences, without a foothold in the solid world of facts, that, in giving their shadowy creations to the people, they are inviting the cold scrutiny of an aggregate common-sense that never fails in time to separate the true from the false.

But temperaments have been made to play a more agreeable *rôle* in human affairs than in defining physiological crimes. In the history of this physical attribute it is interesting to cite its literary aspects. Ben Johnson devoted whole plays to the idealizations of individual temperaments, in which a peculiarity was made to play its part as a *dramatis persona*. The keen and careful analysis of the poet is immortalized in his play of "Every Man in his Humor." Shakespeare proved himself a good physiologist

3. *Journal of Human Science*, Cincinnati, 1860.

as well as a good judge of a conspirator in contrasting Cassius, "lean and hungry," with men "that are fat; sleek-headed men, and such as sleep o' nights." In the earlier English novels, temperament was given a more careful study than in the modern school of light literature. Goldsmith proved himself an enemy of the humoral pathologists in saying of Olivia, in "The Vicar of Wakefield," that the temper of woman is generally formed from the cast of her features. Fielding, in his creative novel of "Tom Jones," speaks of temperaments in such a happy vein of his inimitable philosophy, that it is worth quoting and remembering: "I make no manner of doubt," he says, "but that, in this light, we may see the imaginary future chancellor just called to the bar, the archbishop in crape, and the prime-minister at the tail of an opposition, more truly happy than those who are invested with all the power and profit of these respective offices." A more perfect description of a sanguine man was never written. Novelists, as a rule, analyze temperaments the opposite of their own in their ideal characters. Scott generally describes the bilious in his heroes and heroines, and is never purely realistic in describing the sanguine type to which he belonged. Dickens is always happier in his female characters, and they are good specimens of the sanguine. Dolly, the locksmith's daughter, is a very truthful portrait of this type; while Mark Tapley, famous as the character may be, is an atrabilious, who is continually violating his physiology by being happy under the very circumstances that bring out the unmixed misery of his class. Dickens himself was decidedly of the lymphatic—a type he rarely attempted in his creations. Richter, in "Hesperus," gives some very perfect studies of temperament; but the court physician in that novel is represented of his own type. George Eliot never violates Nature in her female characters, who are generally described as bilious or sanguine; but the least said about her heroes the better. Deronda is surely a mistake. He is first described as a good specimen of the sturdy, bilious man, and is transformed toward the close of the book into the extreme of the sanguine.

To the scientific mind there is always something assuring when we can leave the field of speculation and enter that of fact. Here chemical analysis brings to our aid positive reasons for a

classification of men and women according to temperaments. Mr. Rees,[1] quoting from the researches of M. Lecanu, gives us the material for constructing the following table. The figures are ratios to 1,000 parts of blood :

TABLE I.—RATIO OF WATER, ALBUMEN, AND RED BLOOD-GLOBULES IN THE BLOOD OF DIFFERENT TEMPERAMENTS.

	SANGUINE.	LYMPHATIC.	DIFFERENCE.
	Water.	Water.	
Females	793.007	803.710	10.703
Males	786.584	800.566	13.982
	Albumen.	Albumen.	
Females	71.264	68.660	2.604
Males	65.85	71.701	5.851
	Red Globules.	Red Globules.	
Females	126.990	117.300	8.874
Males	136.497	110.667	19.830

This proves conclusively that temperaments have their origin deep and unchangeably fixed in the organic life. Can we, in view of this, look doubtingly upon their potent influence on the current of thought and emotions? Water, plasmic material, and the red blood globules—the oxygen carriers of living bodies—rush to the brain in proportions fixed by the law of temperaments; to one brain more, to another less, but with differences sufficient to give vigor, vivacity, tenacity, and mental breadth to the action of one; while the other moves more slowly, its mental life obscured by the smaller proportion of mind food.

There is one point about which the reader needs to have a clear understanding. This is the difference between temperament and idiosyncrasy. "Temperament is built in a man, as bricks compose a wall," says Dr. Southey; "his idiosyncrasy is developed according to the soil in which he is planted, the conditions under which he grows, and the tendency in him to vary."[2] A man has his temperament as a birthright, his idiosyncrasy he acquires, changes, makes it subject to his will, or is ruled by it.

1. "On the Analysis of the Blood and Urine in Health and Disease." London, 1836.

2. *London Lancet,* American edition, May, 1876.

The distinction is broader than this, however. Temperament is a race attribute. It is distributed like plants according to latitude and altitude. The bilious is tropic; it thrives best near the equator. The lymphatic belongs to the races of the North. Between these polar types are distributed races that monopolize temperaments as they do their language. The Celt is sanguine, the Saxon lymphatic, the Gaul nervous, the Latin bilious. Thus, temperament is pandemic, while idosyncrasy belongs to the individual. M. Begin calls the first "la variété organique la plus générale," and the latter "celle qui est plus restreinte."

The tendency among recent writers upon physiology is to exclude the bilious, classing it with the nervous, and making three in place of four. This is the classification of M. Michel Lévy.[1] I shall retain the bilious, as being a term too commonly used by learned and unlearned to be omitted from a popular description.

The sanguine temperament presents marked physical traits. The mean height of the male is five feet eight and a half inches, and of the female two and a half inches less. The head is small comparatively, the face is made square by a firm and angular lower jaw, the forehead is slightly sloping, the nose prominent; it has a determined, resolute, exacting look. Under thirty-five the figures of both sexes are sparely covered with fat, but withal muscular. The chest is large, measuring thirty-five inches in average girth, and the abdomen flat. The complexion is light, and is florid only by exception to the rule; the hair light, light brown, or auburn, and often curly. The mouth is usually large, the lower lip full, and the teeth are regular, with a slightly yellow tinge, which indicates firm and lasting dentine. The sanguine are generally good eaters and drinkers. All of the vital functions are active; the large chest-room, the vigorous heart, the firm muscles, insure a bodily activity that keeps the operations of organic life in unconscious and easy motion. Digestion, assimilation, excretion, and elimination, work in harmony and with vigor.

Mentally, this type is the reflection of its physical traits. The rich blood, by its active circulation through the brain,

1. "Traité d'Hygiène."

causes vivid and active mental action. The general cast of the mind is never gloomy. The mental vision is outward rather than inward, and sees things near or remote tinted by glowing, joyous colors, as through a prism. This mental outlook never implies profound insight, or deep thought, or conscious indwelling. It is the surface of things that is studied with quick and transient glances of all that is pleasant, revolting from the difficult or painful. The sanguine man, therefore, learns quickly and knows a little of everything, and by his ready tongue and quick wit is good company—a thorough good fellow. He is brave from a sense of perfect muscular strength, loving sport and athletic games. He is quick to anger, but soon forgets wrong; a word and a blow, and oftentimes the blow first, are the features of his wrath.

It is in medicine only that the temperaments have practical importance, if we reject Dr. Powell's new science. Sanguine people are prone to acute diseases of the inflammatory type. Apoplexy, diseases of the heart and blood-vessels, hæmorrhages, acute fevers, pneumonia, pleurisy, and closely allied disorders, are the forms of disease generally met with. Dr. Southey assigns to this class the old idea of crises; that is in febrile diseases, at certain times, there will be sudden losses of the fluids of the body spontaneously, by which the diseased action secures a new outlet, and this is followed by a rapid convalescence. These evacuations, if the temperament of the patient be understood, are never interfered with by the physician, as they are Nature's own efforts to throw off the disease. Rapid recovery, or a speedy fatal result, may generally be looked for among sanguine people. In this temperament the physical part of man reaches its most perfect expression; the body is here in even balance with the brain. Such a combination as that of persistent intellectual effort with a typical sanguine temperament is rare. Prof. John Wilson (Christopher North) is an example of this, and of which there is scarce another illustration in literature. This temperament, finding its purer expression in a near approach to human animalism, with soul and body adjusted and evenly poised, a happy mingling of mind and matter, must surely have been the type of the Miltonic man. The fancy cannot paint him other than this, and believe him capable of contending with the

dangers, obstacles, and unrelenting hardships of his life. Of this type have the sailors, colonists, soldiers, and explorers, generally been—all men who lead in the battle with Nature's obstacles.

In the lymphatic temperament we have a direct antithesis of the sanguine. Typically, the lymphatics are heavily framed, the limbs are clumsy and large jointed, awkward and slow in movement. This is due to the thickness of the articular surfaces of the long bones, and this also explains the large wrists and ankles; the head is large, the face unanimated, thick lipped, pale, and with large features, the expression listless and apathetic; the eyes are blue or gray, the hair white, blond, or light auburn, and abundant. The male figure is between five feet eight inches and six feet two inches in height, the female five feet six or nine inches high (Southey), and such are the proportions that a person of this temperament rarely meets the artistic ideal of human beuty. The texture of the flesh is soft and flabby, and generally abundant, the muscles small and slow in their development. Puberty is late in its advent; this is but a characteristic, however, of the slow and deliberate manner of the general development. Functions are slowly performed and not evenly balanced; the fluid secretions too abundant, the absorbents inactive in comparison; thus, the figure has the deceptive appearance of a superabundant nutrition. This is a one-sided nutrition, the appropriation of fatty material to the neglect of the solid, motor machinery of brawn and muscle.

The mental traits seem to take direction and tone from the bodily characteristics. The passions move slowly and are easily kept under control, in marked contrast to those of the sanguine man, who has no more control than is sufficient to keep him within the not too narrow limits of the social barriers. From the moderate emotional development there is little need of energetic will power. Where the moral qualities have any chance of growth and exercise they are always "good people," orthodox and conservative. The mind acts slowly, but is very retentive, logical and sound in its conclusions. They are persistent in their undertakings, honorable in their affairs with other men; commonplace and common sense govern them in their daily life.

They are apt to be dull companions, but constant and steadfast friends.

This temperament is found in its most perfect form among men; women rarely show it uncrossed, especially as it easily blends with other temperaments. There is no doubt but that in this type there are inherent defects of histological structure. Dr. Southey says it is due to a too exuberant vegetative cell-life. Whatever may be the radical cause, persons of this type are weak in vital energy and short-lived. They are the usual subjects of structural changes, such as scrofula, phthisis, and articular rheumatism, in whom these morbid processes show the largest ratio of mortality. It will be noticed that these are diseases with a marked hereditary force. It would be interesting to study how much of this heredity exists in morbid processes, or in the temperament itself, which offers a fair field for their onset.

Nature exerts herself in a more eccentric manner in the nervous temperament. Here we find greater variety in the physical signs, and diversity in the mental traits. Typical instances of the nervous temperament are not good specimens anatomically. In stature they are below the average, the bones small and lightly covered with flesh in both sexes up to middle life. The head is large and covered with not over-abundant dark brown or black hair; the eyes are dark, the skin dark, sallow and pale; pigmentation of the skin is more abundant than in any other temperament, while the cuticle is hot, dry and firm. The muscles are small and compact. Persons of this temperament are capable of sudden outlays of great strength, but the muscles do not work in harmony, the movements being oftentimes irregular. The want of nervous co-ordination is a marked trait, and tells upon their efficiency in any occupation requiring trained and accurate touch. Dr. Southey explains this by what he calls cerebro-central pre-occupation, which means that the brain and spinal cord are slow in receiving and responding to the wants of different and remote parts of the body. This is further shown in the unequal distribution of the circulation, the head being often hot while the feet are cold, or the extremities are cold while the body maintains a nearly febrile temperature. The heart beats more rapidly than in other temperaments, or is attended with nervous irregularity in its action. Functionally the nervous

temperament is liable to serious complications; the liver is one of the organs more liable to acute derangement—not, however, in the direction of over, but rather that of under action. Digestion is a delicate function, the merest trifle interfering with its proper performance. A leading trait of the nervous temperament is the mutual reaction between it and the vital glandular functions; thus sudden mental or nervous impressions will upset the whole glandular machinery, or serious mental or nervous disturbances result from causes acting in the opposite direction.

If we were to select any one quality as the leading trait of the mental constitution of this type, it would be the great emotional tension. The emotions often usurp the place of higher faculties, and reason, judgment, and the sense of right or wrong, are biased or replaced by emotional qualities. They have an acute sense of right or wrong, but they are disposed to give it a personal rather than a vicarious application. They have an extraordinary capacity for both pleasure and misery, and the nervous man may be said to be undergoing one or the other through life, never knowing what it is to be in the happy mean of negation. They are never contented with their surroundings for any great length of time, but chafe and fret against their fate, no matter how happy it may seem. They have great fixity of opinion, and but little respect for that of others; and are prone to find a particular antagonism in persons of their own temperament. The sexual emotions are unduly developed, oftentimes giving tone to the character, or acting with explosive violence. Persons of this type are not among those who form the grand aggregate of the conservative opinion of society, the inflexible and implacable character of which we all know, and which upon the emotional tension of the nervous man often reacts harmfully rather than well. Typical instances of this temperament are confined to the male sex, the other sex usually showing a cross with the sanguine or bilious.

This temperament does not show a liability to any class of disease, but gives its own characteristic reaction upon the disease itself. From the ascendancy of the nervous system in the physical and mental composition, diseases of the nerves are very liable to appear, but not as a primary derangement any more than as a complication grafted upon some previously existing disease.

Nervous headache, neuralgia, epilepsy, insomnia and hysteria, are among the nervous affections most liable to appear, either as primary or secondary derangements. With this class it is difficult to give an opinion as to the result in any serious disease (prognosis), as they often die of diseases that in other temperaments are deemed trifling; and then, again, on the contrary, make most surprising recoveries. With them the will-power is oftentimes an element in the recovery, throwing off the disease by the determination not to yield to its influence. There is no doubt but that this temperament is more liable to mental derangement than any other; the great emotional intensity and the difficulty of moral control laying the mind open to causes that tend to produce insanity. Many of the nervous constituents of this type belong to the bilious temperament. We have but to tone down the nervous excitability of the first by an addition of the phlegm of the lymphatic, and add flesh to the spare, nervous figure, and we have the bilious temperament. In its typical phase, the subject is apt to be grave, taciturn, even morose mind and body move slowly but surely, not eccentrically, but by determination and conviction. Persons of this temperament are remarkable for inflexibility of will, sound judgment, strong convictions, abiding affections, and great love for those dependent upon them.

The study of the relations of temperaments to development and vitality is one of great interest. While we know tolerably well their reaction with disease, and the groups of diseases that are liable to cluster round them, we have but few facts bearing upon the normal relations of the temperaments to vital capacity. There are many difficulties in the way of this study. In the first place, we have no unit of measure or comparison, and, in the next, it is difficult to collect the facts. In a very remarkable work consisting mainly of tabulations of a vast number of data relating to anthropometry, or the measurement of men, I discovered facts that throw considerable light upon this subject. During the late war of the rebellion the provost-marshal-general had to pass upon the fitness for military service of a vast number of conscripts. The results of over a million examinations are embodied in two massive quartos, by Dr. J. H. Baxter, late chief

medical officer of that bureau of the War Department.[1] From the elaborate statistical table of Dr. Baxter, I am able to construct a few tables that throw light upon some of the more obscure relations of temperaments. The facts embodied in the tables are picked out here and there from this mass of tabulation; while the figures have suffered no manipulation, except such as may be necessary to arrive at mean values.

A word as to the value of complexion as indicating temperament. A light color of the hair and skin, and blue or gray eyes, instead of indicating any one temperament, define broadly a group of two—the sanguine and lymphatic. A sallow or dark complexion, with black eyes and hair, indicates the bilious and nervous, and in this country, among natives, probably an excess of the latter. If, for the sake of narrowing the dark-haired group, we adopt the more modern classification, and ignore the bilious temperament, we have in this class only the nervous, while in the first group we have both the sanguine and lymphatic, with no means of separating them, except that the national characteristic shows an excess of the sanguine over the lymphatic, probably about the ratio of three to one.

TABLE II.—VITAL CAPACITY AS INDICATED BY RATIO OF CHEST-EXPANSION OF OVER THREE INCHES FOR ALL HEIGHTS TO COMPLEXION. Based upon the examination of 190,621 American-born white men accepted; expressed in ratios of 1,000.

GIRTH OF CHEST AT EXPIRATION.	LIGHT.*	DARK.†
Under 29 inches	3.588	1.141
29 and under 31 inches	37.654	15.285
31 " " 33 "	98.387	46.906
33 " " 35 "	103.015	56.605
35 " " 37 "	46.255	26.793
37 inches and over	12.676	7.151
Total number of men accepted	126,445	64,176

*Blue or gray eyes; light hair. †Black or hazel eyes; dark hair.

Table II shows the relation of chest-expansion to complexion. The range of chest-movement, while it cannot be deemed an absolute measure of vitality, which must be regarded rather as the sum of organic and functional action than the degree of perfection in any one set of organs, yet may be fairly assumed to bear a close relation to the general vigor of the system that defines

1. "Statistics, Medical and Anthropological, of the Provost-Marshal-General's Bureau." By J. H. Baxter, A. M., M. D. Washington, D. C., 1875. Two vols., 4to.

the quality of vital activity. A free chest-expansion implies a large consumption of oxygen, a corresponding degree of force and activity in the circulation of the blood, and this, in its turn, calls for a large demand for food, with a proportional muscular vigor. In the table, a chest-expansion of over three inches is taken as the basis of comparison, for the reason that, at an expansion less than this, men of impaired strength may be included. It is but necessary to glance at the table in order to understand all that is implied by it—that size and muscular vigor of the sanguine and lymphatic greatly exceed these conditions in the nervous.

TABLE III.—RATIO OF DISEASES TO COMPLEXION.

DISEASES IN GENERAL DIVISIONS.	No. examined, 117,029.	No. examined, 217,292.
	DARK.	LIGHT
	Ratio per 1,000.	Ratio per 1,000.
General Diseases	26.857	31.552
Diseases of the nervous system	11.322	12.366
Diseases of the circulatory system	30.881	36.614
Diseases of the respiratory system	9.271	10.902
Diseases of the digestive system	87.978	95.894
Diseases of the urinary system	1.871	2.467
Diseases of the generative system	6.392	7.713
Diseases of the organs of locomotion	30.334	37.180
Diseases of the cellular tissues‡	0.752	1.063
Diseases of the cutaneous system	11.638	11.860

‡ This division includes abscess and obesity only.

In Table III we have the ratio of disease to complexion. In this, the light complexions show their marked predisposition to skin diseases, and, notwithstanding their free lung-expansion, show a nearly equal liability to diseases of the respiratory organs with those of dark skins. The light men prove their greater glandular and muscular activity by their excess over dark in diseases of the digestive, circulatory, and locomotor systems; while the dark group, although composed largely of men of nervous temperament, nearly equal the light in frequency of nervous diseases. It is interesting to note that, in the same table from which Table III is compiled, Dr. Baxter gives the total of dark men rejected for all diseases at 38,916, and of the light 83,700, a difference rather less than that indicated by the mean difference as exhibited in our table. In general diseases, which include fevers, infectious diseases, and all others not confined locally, we find the light men leading the dark by a difference

only equaled by their excess over the latter in diseases of the digestive system. This is due, I think, in a great measure to the predisposition of the sanguine to diseases of the febrile or inflammatory type, as has been already mentioned.

TABLE IV.—RATIO OF DEFORMITIES TO COMPLEXION.

DEFORMITIES.	No. examined, 117,129. DARK. Ratio per 1,000.	No. examined, 217,321. LIGHT. Ratio per 1,000.
Curvature of spine	4.110	4.874
Atrophy of limb	3.640	4.303
Club-foot	1.128	1.579
Wry-neck	0.103	0.143
Deficient size of chest	11.100	17.405
Deformity of chest	2.128	2.996
Loss of limb	0.598	0.686
Defects or deformities of hand	7.032	7.699
Defects or deformities of foot	8.605	9.899

Table IV gives an idea of the ratios of deformities in the two groups, and, while not proving much either way, presents a few facts of great interest. It will be observed that the physical defect which shows the greatest difference, and that in favor of the dark class, is deficient size of the chest. In view of the fact that light men exhibit a larger range of chest-expansion, this excess in the defective size of the chest is unlooked for. The other chest defect is deformity, in which the difference in ratio in the two groups is only about .18. The fact that two classes are made in the chest deformities leads me to suppose that the deformities are congenital, or the result of defective development in childhood; while the deficiency in size is the result of disease or injury later in life. This supposition opens the way to an explanation of the phenomenon. Owing to the greater liability of the light, or partly sanguine group, to active inflammations, a potent factor in causing this deficient size of the chest is inflammation, mainly pleurisy and pneumonia, and, as a not uncommon result, a collapse of one, or both, of the chest walls. This theory is the only one that offers a reasonable explanation of a very remarkable statistical result. The increased ratio in both groups, but notably in the light, of defects or deformities of the feet rather than of the hands, while having no relation to the difference of temperament, shows the careful way in which Nature protects the natural weapons of human beings—

the hands. It confirms, in broad way, what has probably been noticed by the observant reader, that deformities of the lower are more frequent than those of the upper extremities.

These few figures, taken from Dr. Baxter's vast collection of statistics, if not demonstrating anything positively, have at least the merit of not proving too much—a common fault of figures, if we are to believe the anti-staticians. They are important, however, in showing the direction in which the study of temperaments may be pushed in order to give practical results. Social reformers, so called, human science men, and less respectable students under various names, have used temperaments as their physiological basis for widely different theories. To one who is content with marriage as established by law, society and religion, it is a suspicious circumstance that this is the social relation that has sustained the most determined assaults. The physiological attacks have been made in the interest of marriage reform, "natural marriage," and of no marriage at all. While there is very strong evidence that intermarriage between relations tends to the deterioration of the offspring, there are hardly any facts showing that the matrimonial union of healthy persons of like temperaments has the same effect. It is true that social theorists assert the contrary, but they do so without considering that the intermarriage of kin, from which they draw their chief arguments, is surrounded by conditions that cannot exist in the intermarriage of like temperaments. That there are deep-lying physiological reasons against the union of relations, we need go no farther than the oft-quoted fact of the sure impairment of the stock of domestic animals from inbreeding, to establish. Whatever the source of this gradual impairment may be, it is wanting in the marriage of those who are allied only by the similarity of temperament. In the absence of conditions that are necessary to render the arguments drawn from analogy valid, the advocates of the theory of physiological incompatibility are obliged to fall back upon facts having a direct bearing, and they have, in this field, as yet, reaped no harvest. There is, however, in the human family a sort of natural selection existing, that renders a marriage of like temperament not an ordinary occurrence. Both Dr. Ryan and Mr. Walker, in their works on marriage,

refer to the common tendency of one sex to seek the opposite temperament in the other. But, upon the subject of matrimony, even in its physiological relations, society unwittingly does very well.—*Popular Science Monthly.*

HISTORY OF THE DYNAMICAL THEORY OF HEAT.*

BY PORTER POINER.

About one year after the reading of the famous paper of Rumford, in the early part of 1799, Sir Humphry Davy, then but twenty years of age, published his first scientific memoir, entitled "An Essay on Heat, Light, and the Combinations of Light." Clearly enunciating the two systems of hypothesis previously held, he chose to follow Newton in rejecting the materiality of heat, while still clinging to the corpuscular or emission theory of light.

His position with respect to the existence of caloric he asserted in this thesis:

"THE PHENOMENA OF REPULSION ARE NOT DEPENDENT ON A PECULIAR ELASTIC FLUID FOR THEIR EXISTENCE, OR CALORIC DOES NOT EXIST;"

proceeding to maintain it by a series of experimental *reductio ad absurdum*.

Premising that the temperature of a body could not be increased unless either its "capacity" were diminished from some cause, or heat were added to it from still other bodies *in contact*, and observing a production of heat to be consequent on friction or percussion, he enumerated the following as including all possible explanations of the phenomenon consistent with the assumption of caloric:

First, the production by the friction of a specific diminution

*Introduction to an unpublished work on Thermo-Dynamics.

in the "capacity" of the body, whereby caloric would be disengaged, and thus made sensible. This was the supposition which Count Rumford showed to be quite incompatible with the inexhaustibility of the supply.

Second, the liberation of caloric during some slow process of combustion accompanying the friction, the source in this case being the oxygen of the surrounding medium. This contingency was likewise anticipated by Rumford, who failed to detect any indications of such an action.

And, third, the production of some occult change in the bodies rubbed, whereby they might acquire the property of abstracting an unusual quantity of heat substance from surrounding matter.

His argument against the existence of caloric depended, therefore, upon showing that these different suppositions were all contrary to the indications of experiment, whence the inference as to the untenability of the hypothesis itself. But, although this method of reasoning has been characterized as "somewhat confused," the following experiments upon which it was based are now considered classical.

Two parallelopipedons of ice, initially at a temperature of 29° Fahr., were fastened in an apparatus by which they might be rubbed together, and kept in a continued and violent friction with each other. They thus were almost wholly melted, the temperature of the resulting water being "ascertained to be 35°, after remaining in an atmosphere of a lower temperature for some minutes." The fusion also was observed to take place only at the rubbing surface.

From this experiment it was therefore to be inferred that the "capacity" of a body was not necessarily diminished by friction; for, according to the discoveries of Black, the melting of a quantity of ice could only take place with the absorption of a definite quantity of heat—its latent heat of fusion.

Upon the second supposition, Davy remarked:

"From this experiment it is likewise evident that the increase of temperature consequent on friction cannot arise from the decomposition of the oxygen gas in contact, for ice has no attraction for oxygen. Since the increase of temperature consequent on friction cannot arise from the diminution of capacity or oxi-

dation of the acting bodies, the only remaining supposition is, that it arises from an absolute quantity of heat added to them, which heat must be attracted from the bodies in contact. Then friction must induce some change in bodies enabling them to attract heat from the bodies in contact."

To determine, therefore, upon this last alternative, he performed the following experiment:

A block of ice, having a small channel cut around its upper edge, was placed under the receiver of an air-pump. The channel was filled with water, and upon the block, though not in contact with the water, was also placed a clock-work so contrived that one of the external wheels of its machinery came in contact with a thin metal plate. By the friction between these surfaces a considerable amount of heat could be produced, which might be made to melt wax, tallow, or any similar substance fusible at the temperature which could be thus produced.

The receiver, previously filled with carbonic acid gas, was next exhausted as completely as possible by the air-pump and absorption by caustic potash; upon then setting the machine to work the wax was melted rapidly, and the temperature of the whole apparatus increased by more than 1° Fahr., thus proving the excitation of heat under the conditions imposed.

Consistently with the remaining supposition—the third—it was then only to be inferred that caloric had been collected from the bodies in contact. Neglecting, however, the vapor of water which formed the rarefied atmosphere within the receiver, the only other body in contact with the apparatus was the ice. But against the assumption of this latter having furnished any heat, Davy here drew attention to the water still remaining liquid in the canal, and which presumably would have been frozen had the ice parted with any heat.

It is easy to perceive that such a course of reasoning was neither exhaustive with respect to the non-existence of caloric, nor conclusive as to the dynamic character of heat. For had he even been successful in demolishing the doctrine of caloric, the simple refutation of one physical hypothesis could never have been construed into more than an increase in probability of all those opposed to it; and in this instance, perhaps no considerations would have been accepted as conclusive by the materialists, which, failing to experimentally establish the true nature of

heat, should still have left their favorite notion open to any modification, however artificial, which might reconcile it in the least degree with facts which would be doubted and distorted in the interest of these preconceived opinions.

Heat being only a particular phase of energy, it was necessary and sufficient to show, as done by Rumford, with respect to its frictional excitation, that its production depended only on the expenditure of energy—implied in its inexhaustibility—and always in the same degree, as he proved by special determinations.[1] It was the subsequent extension of this experimental process to all modes of heat production that constituted the great work of Joule, to be described hereafter.

But if Davy thus failed to render his experiments truly conclusive against the materiality of heat, his subsequent observations showed that individually his perceptions were most clear and definite.

Heat, ultimately, he conceived to depend upon molecular motion—calling this the repulsive motion—and to produce an effect exactly opposite to that of cohesion. The action of this motion in altering the state of aggregation, he interpreted essentially as is the custom now, and spoke of temperatures as indicating the relative quantities of repulsive motion in the same substance. He also mentioned three modes in which this motion might be increased:

"1. By the transmutation of mechanical into repulsive motion, that is, by friction or percussion. In this case the mechanical motion lost by the masses of matter in friction is the repulsive motion gained by the corpuscles.

"2. By the motion of chemical combinations of decomposition.

"3. From the communicated repulsive motion of bodies in apparent contact, that is, by conduction simply. And subsequently he generalized this statement in the dictum:[2]

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1. Professors Tait and Balfour Stewart are authority for the statement that "Rumford pointed out other methods to be employed in determining the amount of heat produced by the expenditure of mechanical power, instancing particularly the agitation of water or other liquids, as in churning."—(Tait's "Historical Sketch," p. 7; Stewart's "Elementary Treatise on heat," p. 307.)

2. "Elements of Chemical Philosophy," 1812. Complete Works, vol. iv., p. 66. The laws of motion here referred to were those of Newton,

"The immediate cause of the phenomena of heat, then, as Lavoisier long ago stated, is motion, and the laws of its communication are precisely the same as the laws of the communication of motion."

These essays of Rumford and Davy failed to produce, with a few rare exceptions, any perceptible effect upon the scientific opinions of their contemporaries. There would seem to have prevailed at this time a remarkable incapacity to appreciate the importance of experiments whose indications were opposed to preconceived ideas, and an antipathy to engage in unfamiliar issues; and the same distrust and indifference which so deadened the brilliance of Fresnel's immortal work in France proved quite effectual in deferring for the time the discoveries which might otherwise have followed the immediate development and experimental prosecution of this theory. Whatever interest was awakened seems to have been, for the most part, displayed in the petty, irrelevant objections, and misstatements even, brought against their methods of experiment and observed results; and the injustice of which, when not apparent, might have been easily exposed by a careful repetition or extension of these same determinations.

Dr. Thomas Young, however, in his "Lectures on Natural Philosophy," delivered at the Royal Institution, and published in 1807,[1] assigned to them their true significance, and, reviewing much after Bacon the existing state of experience upon the question, drew forcibly attention to the superficiality of the views of those who still adopted the hypothesis of caloric.

In 1810 Haldat performed an extended series of experiments upon the heat produced by friction between various metallic surfaces.[2] The results which he obtained were not, however, decidedly confirmatory of either supposition, but especially serve

especially the third, application to molecular magnitudes being included, and the modifications introduced by the new facts as to the effect of friction understood; "in Newtons's day, and long afterward, it was supposed that work was *absolutely lost* by friction."—(Thomson and Tait, "Natural Philosophy," p. 108.)

1. "Lectures on Natural Philosophy," vol. i., p. 653, *et seq.*

2. *Journal de Physique,* vol. lxv., p. 213; *Nicholson's Journal*, vol. xxvi., p. 30.

to increase our admiration of the acumen of Rumford in perceiving and stating the true law of its excitation.

The rubbing surfaces employed by him were similar in size and shape; the pressure between them was maintained nearly constant in several different experiments; but the power or energy was received in measured quantities, and from an indefinite source, namely, the pulley of a turning-lathe.

The quantities of heat developed for the same number of revolutions, or in proportionate times, were naturally, therefore, different for different metals; but as to the cause of this diversity he hazarded no positive opinion, and indeed his recorded observations do not seem susceptible of reduction to any particular theory. Had he measured the energy absorbed, or the co-efficient of friction between the rubbing surfaces, he might possibly have been able to trace some relation between them and the heat produced in the operation. As it was, his observations as to difference of capacity, the influence of density, etc., were equally confused with the results, which he obtained on varying the pressure and substituting different metals; and although upon the whole his conclusions were adverse to the calorists, they were not definite enough to attract any notable attention.

In tracing thus far the inception of mechanical heat theory, we have seen two important generalizations made: The one, fully attested by experiment, referring to the transformation of work into heat in a peculiar class of operations, and entirely independent of hypothesis, namely, that "the heat generated by friction is exactly proportional to the force with which the two surfaces are pressed together, and to the rapidity of the friction." The other, more comprehensive, including in the spirit of its enunciation thermal phenomena of every variety, and to a greater or less extent dependent on molecular and other hypothesis. These early statements are quite characteristic of, and may be used to illustrate, a subsequent division of our subject necessitated by experimental difficulties of investigation and verification.

The proposition that the entire energy existing in the universe is a magnitude as definite and unchangeable as the quantity of matter which it contains, is now considered one of the most fundamental and far reaching in natural philosophy. The experi-

mental evidence possessed as to the fact appears for the most part in the invariability of the ratio of any dynamic magnitude of a definite kind which disappears to that of another kind which is thereby produced, and the numerical value of which, for a particular transformation, depends only on the relative magnitude of the characteristic units as compared by the same standard system of dynamic units. That is, that the conversion of one manifestation of energy into another takes place with as great certainty and absence of waste, and with the same integrity of the elementary magnitude, as the more formal conversion of foot-pounds into kilogrammetres, or British thermal units into calorics. To the experimental establishment of this principle as involved in transformations between heat and work, and which is called the First Fundamental Law of Thermo-Dynamics, we shall return hereafter.

But in the transformation of heat into mechanical effect or work, an additional principle has been found to hold, respecting the transformable quantities of these two magnitudes as influenced by temperature, and which is known in like manner as the Second Fundamental Law of Thermo-Dynamics.

Experience has not as yet encountered any phenomena at variance with these fundamental laws; which furthermore agree with the strictest requirements of intuitive science, and illustrate, respectively, the axioms that nothing is by natural means creatable from nothing, and that things are equal to the same thing only which are equal to each other. In the development of these two principles, and the application to them of empirical laws with reference to the behavior of bodies under the action of heat or mechanical effect, consists the first principal division of the subject in which the results obtained are generally reliable.

But in assuming a complete analogy between molecular and mass energy, and in tracing the consequence of this assumption through the different forms of material aggregation, the conclusions reached are generally much beyond the present power of experimental science to explicitly confirm, and, although many of the results obtained in these investigations are of great probability, they yet are of inferior certainty to those properly included in the first division.

In short, although the laws which govern the relations of

molar energy to heat are in the abstract positively known, yet in endeavoring to trace the distribution and precise condition of energy when it becomes absorbed within a body, or *vice versa,* the mode and minutest detail of its transformation into gross mechanical effect, the most consistent theories have heretofore depended on the hypothesis that actual or real heat is a condition of molecular kinetic energy, and that the various latent heats are due to potentialities of molecular arrangement.

The full extent to which this principle of the indestructibility of energy had previously been recognized, or involved in the dispute as to the intimate constitution of heat, may be inferred from what has already been given of the history of heat theory. But in 1822, M. A. Seguin, in a letter to Sir J. F. W. Herschel,[1] explicitly asserted it in support of the dynamical existence of heat, and in explanation of the work obtained from caloric in the steam-engine. The view of the subject he claimed to have derived, some years before, from his uncle, the celebrated Montgolfier.

Soon after he restated these considerations in a letter to Sir David Brewster,[2] wherein by a perfectly legitimate course of reasoning, and in a very lucid manner, he showed that the accepted teachings of the calorists led to a violation of this principle of the conservation of energy. For, quoting his own language:

"If we suppose, indeed, that at each stroke of the piston of a high pressure steam engine the quantity of caloric employed is represented exactly by the elevation of temperature of the water of condensation, abstracting all loss, it follows that we have lost nothing in obtaining a very great effect, and that, if it were possible (which is supposable)[3] to condense the caloric contained in a mass M into another represented by $\frac{M}{x}$, in such a manner that it may be reduced into vapor at the primitive pressure, we may, by means of a small quantity of caloric, produce an indefinite number of oscillations."

He expressly stated, therefore, that after a mechanical effect

1. Published in the *Edinburgh Philosophical Journal,* x., p. 280.

2. Published in the *Edinburgh Journal of Science*, iii., p. 276, 1825.

3. A particular instance of this supposition will be seen in our account of Carnot's engine.

had been produced through any given thermal agency, as in a steam engine, only that quantity of molecular motion or heat which had not been thus appropriated would remain as heat.

To him, therefore, undeniably belongs the credit of having first publicly urged the principle of the conservation of energy against the materiality of heat, and of having considered in this connection the reverse phenomenon of the performance of work by thermal agencies.

The only indefinite or erroneous particular in his statement was that arising from the rather incautious introduction of molecular hypothesis. His leading argument was thoroughly scientific, but the oversight or neglect to refer explicitly to the disturbing effect which latent as distinguished from sensible heat might exert upon the experimental verification of his principles, served afterward as point of attack upon the accuracy of his reasoning in general, and an opportunity, abundantly improved, to detract from his true merit as an early supporter of the mechanical theory of heat.

This criticism depends upon and applies with still greater justice to a principle which he subsequently enunciated in a work on railways,[1] in treating of the motive power of heat, namely:

"La force mécanique qu'apparait pendent l'abaissement de température d'un gas, comme de tout autre corps qui se dilate, est la mesure et la représentation de cette diminution de chaleur."

If in the single term "chaleur" Seguin intended to include both sensible and latent heat, his principle was undoubtedly correct; but it is to be inferred from an indicated method of determining the relative dynamical value of heat and mechanical units,[2] that he had quite neglected to take into account a change of molecular energy other than that of sensible heat.

Nearly identical with these, though much more celebrated, were the subsequent speculations of Dr. J. R. Mayer upon this subject. In a memoir published in Liebig's *Annalen*, for May, 1842, entitled "Bemerkungen über die Kräfte der neubelebten Natur," he undertook to answer these questions: "What are we

1. Entitled "Etudes sur l'Influence des Chemins de Fer." p. 378, *et seq.* Paris, 1838.

2. The method indicated, with the data then at his command, for steam, gave 650 kilogrammetres as the mechanical value of an increase of temperature of 1° Cent. in one kilogramme of water.

to understand by force? and how are different forces related to each other?" Toward the latter part of the disquisition he entered upon the subject of the mutual convertibility of heat and mechanical energy, considering the generation of heat by the shock or gradual stopping of a falling body, by friction, and by compression; and illustrating by the heat excited in the bearings and rubbing surfaces of water mills and railway trains; and by the diminution of the earth's bulk in the falling of a body to the ground.

In this he first expressly used the term equivalent, in speaking of the relation of heat, to mechanical effect; and by the same method as that employed in the deduction of Seguin's value, though with more accurate data, found the distance through which any mass of water would have to fall, in order that its temperature, by the shock of sudden stoppage, might be raised from 0° to 1° Cent., to be 365 metres.

The physical reasoning upon which he founded this determination was manifestly incomplete, if not erroneous; and, on this account, his claims as an original promoter of correct theory have been made of late the subject of considerable dispute. In view of the historical importance attaching to this point, and because an allowable explanation of the phenomenon referred to will illustrate very fully the received distinction between sensible and latent heat, we here make a slight digression to consider more particularly the thermal effect attending the compression of elastic fluids.

The term *specific heat* is ordinarily employed to designate that quantity which it is necessary to impart to unity of weight of any specified substance, in order that its temperature may be raised by one degree; no discontinuous change of physical state occurring. A part of this heat, it is thought, is used in raising the temperature of the substance, and thus increasing the *real heat* or thermal contrast of the body; while the remainder is expended, in producing, as it were, some change in the potentiality of intermolecular distance, or molecular motions, not indicated by the thermometer, but in general attended by the expansion or contraction of the body heated. The energy existing in this latter form, and measured in heat-units, has been called by Clausius the ergonal content of the body.

If we were, therefore, to suppose the following effects produced in a specified manner, during the reception of a quantity of heat by any portion of an elastic fluid, namely, an increase of temperature, a change in the mean distance or motions of the molecules not causing any variation of temperature and a performance of external work by the consequent increase of volume against exterior resistance, it is evident that we could not consider any one of these effects to be the dynamical equivalent of the whole acquisition of heat. Much criticism upon the original reasoning of Mayer has therefore been called forth by this fact, that, without proving the absence of the second effect above mentioned, or in any way referring to the possibility of its disturbing influence upon the calculation, he arbitrarily assumed that the mechanical energy expended in compressing atmospheric air should be regarded as the mechanical equivalent of the heat thus rendered sensible.[1]

But though erroneous in principle, this method of determining the mechanical equivalent of heat, was afterward shown by Joule to involve no sensible inaccuracy of result in the case of air and other permanent gases.[2]

The experiment by which this conclusion was attained consisted in the repetition, with a slight but very important modification, of one originally designed by Gay-Lussac to investigate the effect upon the temperature of a gas of its free expansion into a vacuum.

The apparatus consisted of two reservoirs, which might be joined by connecting tubes and a coupling nut, and each closed

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1. Besides, the analogy which he drew between the heat produced upon the sudden stoppage of a falling body, constituting a diminution of the earth's bulk, and the forcible compression of an elastic body, is by no means an admissible one, and in seeking to justify this view by the following statement: "Yet just as little as it may be inferred from the relations of falling force to motion, that falling force is motion, so little is the conclusion admissible in the case of heat" (that heat is motion). "We much prefer to adopt the opposite conclusion, that in order to become heat, the motion—either simple or vibratory, as light, radiant heat, etc.—must cease to exist as motion"—he succeeded only in rendering the subject more indefinite and confused.

2. "On the Changes of Temperature produced by the Rarefaction and Condensation of Air."—[*Philosophical Magazine*, 1845, (3) xxxi., p. 376.

independently by a perfect stop-cock. Into one of these dry atmospheric air was forced until a tension of about twenty-two atmospheres at the ordinary temperature of the room was attained. The other was exhausted by an air-pump. Being then coupled together, they were immersed in a tank containing about sixteen and a half pounds of water, which was stirred, and its temperature taken on a very sensible thermometer, indicating approximately thousandths of a degree. The stop-cocks were next opened, and the air allowed to rush from one reservoir to the other until the tensions were more nearly or quite equal in both. Lastly, the water was again stirred and its temperature noted. A correction was obtained after each experiment, by noting the increase of temperature caused by an equal amount of stirring, uninuflenced by any possible effects of the expansion.

Five experiments upon the thermal effect thus attending the expansion of atmospheric air, showed a mean increase in the temperature of the water of 0.0074°, while the correction to be applied amounted to 0.0068, leaving a difference quite within the limits of observation by this method. Joule, therefore, concluded that "*no change of temperature occurs when air is allowed to expand in such a manner as not to develop mechanical power.*"

If this result or property of atmospheric air had been known to Mayer, and construed by him to imply the total absence of a transformable, internal store of potential energy in gaseous substance, so that the energy embodying the condition variously styled its pure, real, actual, or sensible heat could only be affected by some external agency, mechanical or thermal, and if the effect upon a thermometer, produced by this condition, had been also known to vary directly with the whole quantity of energy comprising it, the method which he indicated would have led to an admissible result.

But, in reality, Gay-Lussac, from his original experiments, had not come to any very definite conclusions on this point. The temperature of each receiver had been found by him to change; but not using an equivalent device to that of the submerging tank of water, he had not been able to determine, on the whole, whether heat had been lost, or gained, in the expansion. When, therefore, Mayer, in 1849, defended his claims by a reference to these first experiments on this point, the answer

was available to Joule that, prior to his own researches, the all-important principle assumed had not been recognized in science; and that the results obtained by Gay-Lussac tended only to render the question still more doubtful.—*Popular Science Monthly.*

DIAPEDESIS OF LEUCOCYTES IN MAN.

In a short, but very interesting memoir, Dr. Collin, Professor at Val-de-Grâce, studies the migration of leucocytes in man. He shows us how pathological anatomy and clinical experience have confirmed the researches of experimental physiology. It has long been known that when fine colored particles, of vermillion, for example, are injected into the vascular system of animals, the leucocytes take possession of them, bury them in their protoplasm, and circulate, carrying with them these bright red granulations. We can then follow their course, and nothing is easier than to establish their passage through the walls of the vessels, and their extravasation into the surrounding connective tissue. Referring to a fact which he had previously advanced before the Society, M. Collin confirmed his previous observations: in ague-poisoning, and in the melanæmia which is a consequence of it, there exists pigmentary deposits in the various tissues, especially those which are in most intimate contact with the blood, the walls of the vessels. The deposits arise from the red globules of the blood which are destroyed in the splenic pulp. The leucocytes seize hold of these granulations, as may be seen by a microscopic examination of the blood of persons suffering from the fever. Now these are white globules loaded with the debris of red corpuscles, which go to form the pigmentary deposits in the walls of the vessels and in the substance of the different tissues. According to M. Collin, this migration of globules loaded with pigmentary corpuscles is very active; and in countries where malaria abounds, there sometimes appears, after only two or three attacks of fever, the yellow, earthly

tint, due to the general pigmentation of the tissues, consequent upon the diapedesis of white globules charged with pigment granulations.

M. Collin has, at length, seen his views adopted by the majority of observers, and, since his communication to the *Académie de Sciences*, the works of Kelschs, of Cornil et Ranvier, and of Rouget have added the support of their authority to the demonstrations of the learned professor, of Val-de-Grâce.—*Le Progrès Medical.*

NEW TREATMENT OF PLASTER CASTS.

In response to the offer of a prize by the Prussian government for a method of so treating plaster casts as that they may be washed, and at the same time that the pores of the material shall be so closed as to prevent the entrance of dirt, Dr. Ressig gives two different processes whereby the plaster is transformed into a combination, insoluble not only in water, but in soap suds.

The first method is based on the fact that sulphate of lime is changed by baryta water into sulphate of baryta, a caustic lime gradually transformed by the action of the atmosphere into a carbonate of lime, as we know from the similar action of plaster and mortar. Baryta water is prepared by slacking together in a securely corked bottle one part of crystallized hydrate of baryta with about twenty parts of rain water, thus forming a saturated solution. After it has cleared, it is sponged or poured over the plaster as long as the cast will absorb it. The cast is then dried moderately and more baryta water applied, if it still takes it in. This treatment, besides hardening the cast, gives it a beautifully white and clear appearance.

The other method is by using a silicate of potash. To obtain this, water containing about ten per cent of caustic potash is heated to 212° F., and to this is added as much silicic acid as the potash solution will dissolve. Some clay and silicate of potash are precipitated on its cooling. Preserve this liquid in tightly

stopped bottles until no signs of turbidity are seen. When about to use it, throw in a small piece of potash—one or two per cent. The solution is applied by dipping the cast, or by applying the liquid with a sponge or spray. An almost instantaneous change occurs, when the superfluous solution should be carefully washed off with soap suds. Some practice is necessary to determine the the time of exposure by this last method.

Casts thus treated are no longer, so far as their surfaces are concerned, plaster, and are very hard and durable. They are still however porous, and absorb dirt. To close the pores, dissolve one part of castile soap in ten parts of alcohol, and wash the cast with this, which will close the pores. A better way, though more expensive, is to dissolve steatite of sodium in pure spirits of wine, and warm the cast before applying. This gives an almost vitreous appearance to the cast, and produces an exceedingly beautiful appearance.—*American Journal of Dental Science.*

ON THE USE OF COFFER-DAMS AS AN AID IN FILLING SOME CLASSES OF CAVITIES IN THE TEETH.

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From the first year of my practice to the present time I have used the coffer-dam on certain occasions, and it has proved so valuable an auxiliary to me that I have thought that a description of my mode of using it might possibly be interesting, and perhaps afford some hints to others.

With the construction and use of coffer-dams, as they are generally used in engineering, I had become practically familiar while engaged in the practice of the profession of an engineer.

In 1836, the first year of my practice, a gentleman became my patient who had in his mouth a tooth that was badly decayed, but had never given him any pain. He had already consulted several eminent dentists in relation to it, and they had all told

him it could not be filled. It was indeed a desperate looking case. He was anxious to preserve it, if possible, on any terms, except having it filled with amalgam, which he would not have in his mouth. Upon a careful examination, I found that the decay had not reached the pulp cavity.

The tooth was the right inferior second molar, with a large cavity in the grinding surface involving nearly the whole of the crown, and extending from one proximate side to the other. The third molar had been extracted, but the first molar and all the rest of the teeth on that side were in their places. The whole of the right proximate wall of the cavity was gone, and a large portion of the left. The decayed portions were dark brown in color, and in some places almost black, but underneath the decay the bone was very hard. I removed the ragged edges of the margin of the cavity, and formed it into shape; and when I had done the best I could, and it was prepared for filling, it had but two walls, the lingual and labial. The lower margin of the cavity on the right proximate side was below the surface of the gum, and on the side next to the first molar the lower margin was on a level with the gum, and the cavity presented the appearance of a deep groove plowed through the longest diameter of the crown. After I had prepared the cavity I did not know how it was to be filled. It was certainly the most difficult case I had then met with. There was no rubber dam in those days; no adhesive gold. What was I to do with this bothersome cavity? I did not give my patient much encouragement about it, but filled the cavity with a preparation of mastic and cotton, which I used for such purposes, for we had no gutta-percha then, and left it until the next day. The patient came. I examined the tooth again. Almost at the first glance the idea of a coffer-dam occurred to me, and in a moment the feasibility of using such an appliance as an aid to filling a cavity in a tooth became clear to my mind, and I will now endeavor to describe the apparatus that was developed from this suggestion, and the mode of applying it, taking the cavity just described as an example.

It took several days to fully develop this idea into a practical apparatus, but this was done at last, and I took an impression of the side of the lower jaw where the tooth was located, made a

metal model from it, and by means of this model, constructed of gold plate a band that would clasp the whole circumference of the tooth to be filled, from the grinding surface down to and below the lower margin of the cavity. The band was cut long enough, so that, after allowing the proper length for the circumference of the tooth, there would be a surplus on each end of about one-eighth of an inch. The band was then formed as near as was deemed necessary to the shape of the tooth, and the surplus on each end was bent or doubled back on the outside so as to form a loop, the bend being on a line with the perpendicular axis of the tooth. When the ends of the band were brought together, the points where this band was thus bent, and which by this bending process become the ends of this open, broad ring, were accurately fitted with a file, so that the filed surfaces when placed in contact would form a close joint. To fasten these looped ends together there was constructed of gold plate a flat-forked key with two prongs, which were fitted into the two loops which had been formed on the ends of the band when the surplus length was folded back on the outside. And upon placing a piece of rubber, or any other good packing, between the close-fitting ends, and inserting the key in the loops, the band became a strong closed ring, and the joint thus made a perfectly tight one. This band was constructed of such size that when the ends were fastened together, and it was placed around the tooth, it would not fit tight to it, but at the point near its lower edge, where it surrounded the tooth, at the line of the lower margin of the cavity, and for the distance below the margin that it might extend, there would be a space between the tooth and the band of about the fiftieth of an inch in width, and above that point, up to the top of the band, the space would be about double that width.

The use to be made of this space will be apparent as the description proceeds. The lower edge of this band, that would come in contact with the gum, was formed like the edge of a carpenter's chisel, with the bevel on the outside, so as to facilitate its insertion between the tooth and the gum. If in placing the lower edge of the band below the margin of the cavity it should impinge upon the gum so as to produce pain, a slight

touch of the lancet at the point impinged upon would remedy that difficulty.

Having described how this band was constructed, I will now explain how it was applied to the particular case already stated, and converted into a coffer-dam.

The space required between the first and second molars for the adjustment of this appliance had been obtained by forcing cotton floss between them; the band was placed in the position around the tooth where it was to be used, with its lower edge about four-fiftieths of an inch below the lowest part of the margin of the cavity; the ends were brought together on the outside or labial surface of the tooth, a piece of rubber was placed between them, the key was inserted, and the closed joint was formed.

Some small wedges of sandal-wood were then inserted between the tooth and the band to keep it temporarily in place; these wedges were inserted in such manner that the space between the band and the tooth would be of the same width on all sides; tin foil was then carefully packed in this space with a thin instrument.

There was no attempt made to keep this foil dry while it was being packed, but it was made quite hard in this narrow fissure, and in doing that the moisture was all pressed out of it. The packing was first carried around the whole of the inside circumference of the band below and up to the lower margin of the cavity; it was then extended over the whole of the remaining external surface of the crown up to the top of the band, barely leaving the margins of the cavity free.

The small wedges were removed one by one as the packing reached them, and in this way the band was made to fit close and immovable to the tooth, and the space between them made moisture-proof. When the packing inside of the band had been completed, a sufficient quantity of tin foil was packed between the outside of the band and the first molar, to maintain the space between the two teeth that had been previously made by the cotton floss, so that the band could be easily moved when the cavity in the tooth had been filled. When that packing was completed I had surrounded the crown of that tooth with a

moisture-tight coffer-dam, and the cavity to be filled had four strong walls.

After many experiments this mode of packing was found to be the only way by which the coffer-dam could be securely and immovably fastened to the tooth, and at the same time have the pressure equally distributed over the whole surface of what was left of the crown, and thereby avoid the danger of crushing some part of the walls. If the coffer-dam was set up tight around the tooth, with a screw or any other device, no matter how accurately the band may have been fitted, it would be impossible to know that the pressure had been distributed; it is probable that it would be greatest as some one point, and that might be where the wall was weakest and least able to bear such pressure. By the arrangement of this apparatus the filling of that cavity became a very simple matter; the gold could be packed in any direction, and upon the extreme lower edge of the margin that was below the surface of the gum it could be made as solid as at any other point. When the packing of the filling was finished the tin foil that had been packed between the outside of the coffer-dam and the first molar was taken away, the key was lifted out of the loops, and the band removed; the filling was then finished the same as any other would be. This sort of coffer-dam can be applied in the same way, and with great advantage, to cavities with three walls, where any part of the margin is below the gum, or where there are but two walls standing at an angle with each other, as they would be if one was the lingual and the other either of the proximate walls, or it may be successfully used where there is but one of the sides of the crown left. If it should not be desirable to have the band pressed down below the gum the same distance all round the tooth, its lower edge can be formed of such shape that it will only dip down below the edge of the gum at the points where it may be needed, while the rest of the edge will remain at any height desired. It can also be used with great advantage for filling cavities with amalgam where any of the walls are destroyed; then that portion of the band that would come in contact with the amalgam should, previous to the insertion of that substance, be coated with gutta-percha dissolved in chloroform; if the gutta-percha is pure, this coating will be very strong, will dry in a few

minutes, and will prevent the free mercury in the amalgam from acting upon the metal of the band. The band for these coffer-dams can be made of gold, silver, or brass (silver or nickel-plated), or a brass one might be simply tinned. I have often left one of the coffer-dams around a tooth in the mouth for several days at a time without its being disturbed in the least. Within the last two years I have sometimes used amalgam as a packing for these coffer-dams instead of tin foil, where the cavity was to be filled with amalgam, and have been much pleased with its use. It can be very readily and expeditiously applied, and with much less labor than the foil-packing which I had already described. When amalgam is to be used as a packing, the metal band is prepared for it, previous to its being placed around the tooth, by coating its inside with a thin film of the gutta-percha dissolved in chloroform, already described; the amalgam intended for the packing is then mixed in the proportions of equal parts of mercury and alloy fillings, which will make it of about the right consistency for this purpose; it is to be worked down in the space between the band and the tooth with a thin instrument, in the same manner that the tin foil was packed, until the space between the lower edge of the band and the lower margin of the cavity is filled; when this has been done an additional quantity of the alloy fillings is to be mixed with and worked into this pasty mass until there is sufficient added to cause the amalgam to set hard. The remaining space between the external surface of the tooth and the coffer-dam is then filled with amalgam of the consistency of which fillings are usually made; for this purpose it is better to select one of the alloys that will set quick.

Yet more recently I have made some experiments with this amalgam packing for coffer-dams where I wished to fill the cavity with gold, and with very satisfactory results. The only variation made, where gold is to be used, is that the amalgam packing, after having set, is trimmed so as to be entirely out of the way of contact with the gold at the points where pressure would be applied to the latter; all of the exposed parts of the amalgam packing are then to be coated with a varnish made of equal parts of a solution of gum copal in ether and gutta percha dissolved in chloroform; this varnish dries in a few minutes, and

will effectually prevent the amalgamation of any free mercury that may be in the packing of the gold of the filling. I have used coffer-dams made of hard rubber and celluloid, but I do not like them as well as those made of metal; they are not so easily adjusted, and in most cases take a long time to fit.—*Cosmos.*

CLINIC OF DISEASES OF THE MOUTH.

GINGIVITIS—ITS DIFFERENT FORMS—ATTEMPT TO CLASSIFY ITS VARIETIES—ITS TREATMENT BY MONOHYDRATED CHROMIC ACID.

BY M. E. MAGITOT.

Translated from Le Progres Dentaire.

III.

TRAUMATIC GINGIVITIS.—As we have remarked in our preceding classification, traumatic gingivitis comprises the following varieties:

1st. Gingivitis of Smokers, With carbon deposits.

2nd. Tartaric Gingivitis, Due to deposits of tartar at the border of the gum.

3rd. Gingivitis of workmen in certain industries.

Let us consider each of these successively:

1st. GINGIVITIS OF SMOKERS.—This sort of gingivitis consists essentially of inflammation of the free border of the gums with carbon deposits, blackish about the necks of the teeth. It is chiefly found in smokers who make an immoderate use of tobacco, and particularly in smokers who use cigarettes or pipes, both of which are of a nature to excite the greatest irritation in the buccal mucous membrane. It is that form of the disease that represents the first and most simple symptoms, ascribed by many writers to the use of tobacco, which beginning with simple gingivitis, develops into psoriasis and epithelioma in passing through

the general stomatitis, forming aphthus patches and epithelial desquamation.

This form of gingivitis is often complicated with those we shall presently describe—that is, gingivitis due to tartaric deposits, which soon are followed with the carbon deposits, produced by the combustion of tobacco. This combination of the two varieties is essentially due to a more or less entire want of proper care of the individuals, who besides being smokers are negligent as to their teeth.

It follows from this that gingivitis is far from being of the same character in different smokers, for by taking some cleansing precautions they free themselves from its production. This gingivitis is then essentially due to direct irritation of the mucous membrane, caused by tobacco smoke, and to the deposits of carbon upon the free border, and as to this last circumstance let me say that it resembles a certain phenomenon pointed out by Gubler in people who use dentrifices of carbon, and which he designates as *liséré*, an embroidered border, of carbon.

Beyond these etiological characteristics which mark and differentiate gingivitis of smokers, the disease presents itself to our observation under the aspect of a red superficial band, comparatively small in height, and constituting an irregular inflammatory border. The free border of the gum is thickened into a roll, somewhat bare, without suppuration, strictly speaking, without heat or pain in the teeth, and these rolls rest in some manner upon another irregular border, adhering to the surface of the enamel and of the neck represented by the bed of carbon particles which cover them. The special appearance of the implicated gingivitis, in other respects, another peculiarity is, that it attacks only certain isolated points, such as the anterior portions of the superior and inferior dental arches, or in other words, the places most directly exposed to the irritating agents. The posterior portions are rarely affected.

These carbon layers ought to be carefully distinguished from other deposits which cover the surfaces of the teeth. They are invariably black, easily detached by means of a scraper, and composed of amorphous particles insoluble in all reagents. The other deposits are of a very different color: as for instance the greenish stains so common on the surface of the human teeth

and which almost always cover the teeth of herbiferous animals. These last stains are formed of amorphous particles which furnish the coloring matter of vegetables. Various reagents dissolve them—the acids for instance. Besides these greenish stains, we will add the mass of mucosites and alimentary dèbris mixed with numerous parasites, which form more or less thick beds upon the teeth, of which the consistency and extent frequently augment in the course of acute diseases; thus then inaction of the mouth occurs from the suppression of the salivary secretions.

It is to these crust-like masses that writers in general, and M. Gubler in particular, give the name, *mucus*. We have often objected to this nomenclature. In fact the mouth contains no traces of *mucus*, strictly speaking. The mucous membrane which carpets the oral cavity contains no traces of the muciparous glands; only the salivary glands pass a liquid product into the cavity, and it is the mixture of the liquids with the alimentary dèbris, and the epithelial layers in desquamation, the clusters of leptothrix, the parasites, etc., which constitute the deposits upon the surface of the necks of the teeth, whether combined or not with the mass of tartar.

Such is, in a few words, gingivitis of smokers: slight irritation, exclusion of the free border, and carbon deposits subjacent. We have nothing farther to say in a symptomatological point o view, of this form which is, in fine, one of the most superficial and one of the least serious of the various kinds of gingivitis.

2nd. Tartaric Gingivitis.—This form of gingival alteration is essentially the consequence of irritation produced by tartaric deposits, at times quite abundant, on the free border of the gum, which cover certain portions of the teeth and often the entire surface of the alveolar ridge. But we must here say a word or two concerninig the nature and composition of tartar.

Tartar is a concrete stony mass, generally of a yellowish hue, capable of becoming *very* hard, and which is deposited on the surface of the teeth. The localities in which it is found are, by the order of their frequence—the posterior faces of the antero-inferior teeth, situated at the opening of the excretory ducts of the sub-maxillary and sub-lingual glands; the external faces of superior molars in the vicinity of Steno's duct, and the inferior molars. It is rarely deposited on the lingual surface of the

molars of either jaw, and is never found on the posterior face of antero-superior teeth which are not washed by saliva. These deposits of tartar which, when abundant, are indices of the constant alkaline action of the saliva, are often found in great abundance, when for some reason the teeth of one side take no part in mastication. In such case the deposits occur exclusively on the opposite. We have seen deposits of tartar so thick at times that they completely enveloped the teeth on all sides, in the mass. This phenomena is to be compared with the accounts of Pliny and other ancient writers, which tell of united teeth, constituting to all appearances, one single semi-circular tooth for each jaw.

Tartar is chiefly composed of mineral matter, phosphates and earthy carbonates, the relative proportion of which varies greatly according to different analyses. (Berselius, Vauquelin, Bibra.) Thus, at one time we find 60 per cent of phosphates; again, almost the same quantity of carbonates. We can very easily explain the difference in the results obtained; thus, if the tartar analysed has been taken from superior molars, which are generally covered with deposits of parotidian saliva, there will be found a predominance of carbonates, as in the liquid itself. If it be taken from the posterior surfaces of inferior incisors it will be rich in phosphates. These variations of chemical composition are found in the constitution of salivary calculus and are explained in a like manner. The salts, carbonates or phosphates, are in the tartar mixed with and united to a certain quantity of organic matter—the epithelial cells, fatty globules, leucocytes, filiform algæ and infusoria of a species of *vibrio* and *monas*.

IV.

There have been several theories advanced upon the formation of tartar.

M. Serres has admitted the existence of tartaric glands located in the body of the gums and having the property of secreting the tartar of the teeth. Anatomical observations, however, have failed to demonstrate the existence of such glands.

Cl. Bernard's theory asserts that the formation of tartar is due to irritation of the alveolo-dental periostitis, as a consequence of denudation of the soft gums by alimentary fragments during

the act of mastication. He compares this secretion to that which sometimes accompanies periostitis of the bone.

This explanation cannot be admitted, and unless we attribute dental periostitis to some secretory action, we need only to remark, in order to overthrow the doctrine that tartar is frequently deposited on bodies introduced into the mouth; such as artificial dentures in the complete absence of teeth and consequently of dental periostitis.

A third theory is that of M. Dumas, who assumes that there exists in the mouth two kinds of saliva, the one acid, the other alkaline, which supersaturates the first. The acid saliva holds the phosphates in solution, and when the alkaline saliva supersaturates the acid, the phosphates are precipitated.

This theory does not seem to us to conform exactly to truth. In our opinion, tartar is the result of a simple deposit, by precipitation, of phosphates and earthy carbonates held in solution in the saliva by virtue of the organic matter with which they are combined. Upon their arrival in the buccal cavity, the elements are decomposed in contact with the air and mucous membrane, the salts insoluble in water are precipitated and deposited on the surface of the teeth. This view is essentially that adopted by M. Gubler.

The quantity of tartar deposited in the mouth varies widely, according to the subjects and those differences are by our theory easily explained. In the one case, simple saliva may contain in certain individuals a less proportion of earthy salts in solution, and the tartaric deposit will be relatively slight; while in another the deposit may accidentally come into contact with an acid reagent which neutralizes it and causes it to enter into solution again in the saliva. If in the last case a deposit sufficiently small is found enveloped in very strong acid saliva, in spite of the neutralization of the tartar already formed, we can still observe an acid reaction at the necks of the teeth which often induces disastrous effects upon these organs.

The existence or absence of tartar in the mouth presents in the history of different diseases a certain signification, as follows: If very abundant, it indicates a free alkaline reaction of the saliva, like that in the centre where the teeth are situated, and if then it constantly excludes the caries of the teeth, it becomes

the determining cause of gingivitis by simple traumatic irritation of the mucous membrane. On the other hand if there is but little tartar or none at all, it implies acid reaction of the saliva, and in the centre where the teeth are located, with all its consequences upon the condition of these teeth; then between these two extreme states, are grouped the various degrees of feeble alakaline acid or reaction and the various results produced by them.

Against this theory of the formation of tartar, there has been an objection urged on account of the great disproportion often observed of earthy phosphates which are so scarce in the saliva, whereas tartar contains about 60 per cent. This objection is without foundation, if we reflect that the quantity of saliva secreted, on an average, in forty-eight hours, in man is about 410 grammes, in which case, however little phosphates the salivary liquids contain, the formation of tartar can still be explained; for we know that this deposit is produced very slowly, and that many years are required to form a layer of much thickness.

The places chosen by the tartaric deposits, indicate directly the points which will be particularly effected with this kind of gingivitis; but we should further say that other accidental circumstances singularly favor the production of it; thus the loss of one or more teeth, certain diseases of the teeth, caries for instance, or at times an incomplete action, by simple negligence, of a whole side of the mouth. In case that the masticatory functions are performed only on the opposite side, the immediate consequence is that the active side free from all deposits is wholly normal, while the other, encumbered with calcareous masses is soon attacked with gingivitis.

We observe that the intensity of the gingival affection varies according to the quantity of tartar deposited.

In the most favorable cases, there is a simple reddish roll or band, raised by the tartar deposit, which has for its seat the interstice of the gingival border and dental surface, in other words the necks of the teeth. You very frequently find it on the anterior and posterior faces of the inferior alveolar border. The opposite region, the antero-superior, is nearly always free from it, as we have said above, on account of the absence of salivary

secretion at this point, and also because the incessant motion of the tongue and lip continually cleanse the surfaces.

In a more strongly marked form, that is with a very abundant deposit of tartar, the affection is more extended. There is a festooned tumor with true absorption of the gums of the teeth, denuding them to a certain extent.

The gums then present a fungus appearance; they bleed at the slightest touch. Arrived at this stage, the disease is generally complicated with a certain degree of looseness and deviation in the teeth, due to the propagation of inflammation in the alveolo-dental periosteum. But as regards this, we have not extended our topic to the subject of periostitis itself, which only represents, after all, an after phenomenon and a consequence of primitive affection, and which must look elsewhere for its description.

To sum up, the essential and distinguishing characteristics of tartaric gingivits are the results of the presence of tartar in deposits more or less extended and exclusively localized within the places of this material.

As to the treatment of this particular form, without wishing to here prejudge the rules of therapeutics which we will attempt to establish soon for gingivitis in general, we can say previously, that the application of these means will be invariably preceded by the simple removal of the deposits.

Further, you must attempt to cure the disposition or dental lesions that have been the cause of their production; and apply hygienic agents with the view of chemically neutralizing the tartaric product on the place, or to check its return. This will be taken up in another lecture upon "*Rational Hygiene of the Mouth.*"

3rd. Gingivitis of Workmen in Special Industries.—With traumatic gingivitis, there are classed certain inflammations of the gingival mucous membrane, which are peculiar to some industries, independent of other lesions of the same order, which result from intoxication and which will be described with poi sonous gingivitis.

In that class of gingivitis which has recived the name of "*industrielle,*" we find in the most conspicuous place that which

was first described by Putegnat. He found it existing among the workmen of the glass factories of Baccarat, where 95 per cent of the mechanics were affected to a greater or less extent.

The author from whom we borrowed this short description makes the remark—that the different conditions of temperature, of nourishment, of kinds of work, seem to exercise no influence upon the production of this disease; so that the time spent in the workshop seems to be the essential cause of its appearance.

The characteristics which it presents are:—a tumefaction of the free border of the gums, with a swelling of the festoons along the margin of the dental interstices; the mucous membrane is red at first, then changes to a bluish black. It is a kind of *liséré* with thickening very different, according to Putegnat, from *lead liséré* which is in other respects in no way inflamed.

This distinction upon which the author carefully insists was necessary because the work of glass makers can, as we might suppose, lead to comparison with diseases due to leaden preparations.

Finally, there exists in this variety of gingivitis a local peculiarity very important for diagnosis, and one which, in some way, furnishes the etiological nature of it. It is that the disease is accompanied, or perhaps preceded, by caries at the necks of the teeth—caries that hasten to the rapid destruction of the crown, which as though a section was taken out at the level, breaks and falls in. This circumstance leads us directly to a peculiar consequence, viz: that we do not know how to compare gingivitis of glass workers to tartaric gingivitis, provided that the presence of tartar and dental caries exclude the usual reciprocity.

The lesion described by Putegnat is invariably located on the free margin of the gums without evidence of extension either to the buccal mucous membrane or dental periosteum. It follows from this that it is unaccompanied by loss or destruction of the teeth; consequences quite frequent in the other numerous forms.

In the examination of the causes of this affection, Putegnat makes allowances, it is true, for the surrounding circumstances, such as the humidity of the rooms, insufficient ventilation and other different common causes. But in his mind it is evident

that the essential cause is the existence of fine glass dust in the factories, which fill the whole atmosphere and is deposited on the necks of the teeth, or that their presence excites the traumatic lesions with which they are affected.

Unable to produce here any personal experience, let us study again especially this kind of observation, and if we have, hereafter to explain the intervention here of the particles of dust in the production of concomitant caries, we shall easily succeed.

Pathogeny of gingivitis from the manufacture of glass can also be compared to many other analagous explanations; thus it is an action of the same sort as produces ophthalmia in quarrymen, coal men, and it is also proper to recall here that the workmen or miners, as also the workmen of Baccarat, are affected with a disease much more serious and which results from the presence of foreign substances; we refer to deposits of matter in the respiratory ducts that invite tuberculization in rapid effect.

However it may be, the gingivitis of glass-blowers is not the only disease met with in the industries; as for example, workmen employed in the manufacture of arsenical preparations; manfacturers of colored papers, (Imbert Gourbeyre); the manufacturers of iodic and phosphoric preparations, (Lebert et Wyss); the mines of Almaden, (Roussel); but these are forces considered mostly under the head of poisonous gingivitis, and which will be described later. The gingivitis of the manufacturers of Baccarat, is, it is true, the only one which has been so far clearly and nosologically described. But there are surely many others that are essentially of the traumatic character.

Journalistic.

In the January number of the *Pharmacist* it is stated that R. V. Matteson, Ph. G., read a paper before the Alumni Association of the Philadelphia College of Pharmacy, in which he maintained that dialysed iron was an antidote for arsenical poisoning, provided common salt be given the patient immediately after the iron solution, with the object of precipitating the iron in case the gastric juice should fail to be sufficient.

We look over our medical journals with great interest, as nearly every month we find in some of them a "Sure Cure for Toothache." The last specimen of this kind is in the *United States Medical Investigator,* and the sure cure is the tincture of the Plantago Major, the large-leaved plaintain of the door-yard. It seems to be about equally efficacious used externally or internally. We suppose it makes no difference whether the toothache is caused by an exposed nerve or from inflammation at the apex of the fang, or calcification of the pulp, or malarial poisoning, or anything else. It is very probable that the writer was not aware that there was more than one kind of toothache, or that there was more than one cause for this malady, and those who are most profoundly ignorant of the cause or nature of a disease are the ones who are ever ready to enlighten others in regard to their treatment and cure. Plantago, may, however, be useful in some forms of odontalgia, but we shall *know* nothing about it definitely until some one takes up the investigation who knows the difference between an alveolar abscess and a toothache from exposure of the pulp.

The *Louisville Medical News* is a *weekly* journal of twelve pages and presents a very neat appearance, and is filled with articles of interest to all medical and dental practitioners, and whatever it has to present to its readers does not spoil by keeping a month before it reaches its destination.

In the *Buffalo Medical and Surgical Journal* the salicylate of

soda is recommended strongly for acute articular rheumatism, instead of salicylic acid, which is liable to disagree with the stomach.

In the *Dental Advertiser* is an article upon "Pulp Capping," recommending the use of lacto-phosphate of lime for covering the exposed pulp, and over this the oxy-chloride of zinc. The writer says: "The lacto-phosphate of lime I prepare myself." The essentials are a vial of Merck's lactic acid, another of the magma phosphate, which must be kept under water, and a little dry precipitate. "On a piece of glass place one drop of lactic acid; give it as much of the magma as it will digest, and then reduce to the proper consistency by adding the precipitated phosphate."

In looking over our medical literature we find that the editors deal much more in *extracts* than in tinctures, pills, etc. In fact we find no difficulty in finding room in the MISSOURI JOURNAL for all "extracts" from the medical and dental literature of the day which are really worth extracting and also for our original articles.

In the *Monthly Microscopical Journal*, London, we find an *extract* from the *Archiv. für Mic. Anat.* from an article by Prof. Boettcher, upon the structure of the red corpuscle, in which he claims to have demonstrated that the red corpuscles are nucleated and that he can distinguish three kinds of these corpuscles. In order to bring out the distinguishing characteristic of the three classes, he treats the red corpuscles with a saturated alcoholic solution of corrosive sublimate when the nucleus and a nucleolus is plainly seen in the corpuscles of all of the classes.

The *American Journal of Dental Science* gives us a report of the transactions of the Virginia Dental Association. Dr. Johnston described his method of "filling roots of teeth," acknowledging his indebtedness for the method of procedure to Dr. Moore, of Richmond. The method was to make an instrument of block tin, about the size and length of an ordinary excavator, and shape the end of this to the canal approximately. This part fitting the root, was made rough by a course file, and pushed up into the canal. The friction of the walls of the pulp canal

against the tin made it somewhat smooth at the points at which it fitted most tightly, and on withdrawing it, this fact was taken advantage of to lessen its size, and by a few trials the tapering tin broach could be accurately fitted to the entire length of the root. It was now marked the proper length and cut off, and a very little of the point or upper extremity also cut off, and on being placed in position could be driven into the canal, with a slight stroke of the mallet. He never enlarged a nerve canal, but by this method of adjustment, found the work of filling roots so simplified as to reduce the trouble to a minimum.

Dr. Cowardin recommended rhigoline spray in sensitive dentine.

In the *Cosmos* are published the transactions of the Odontological Society of New York.

The subject of building up teeth being under consideration, Dr. Dwinelle said:

A word in reference to the methods which have been described upon the blackboard. Without any vanity, I think I may say that several of the operations there described were substantially set forth in a little treatise, which I wrote in 1855, on crystal gold. I am forcibly reminded, by several of the cases here described, of similar cases which I described in that work. There is one term which has been used in the discussion of these operations which I must take exception to, on the ground that what has once been given to the profession belongs to it, and no subsequent patronage entitles any individual to it. I refer to the term Mack's screws. These screws, at the time of their introduction, many years ago, were given freely to the profession—without money and without price—and were used for a long time under various names. They belonged to the profession for eighteen or twenty years, when they were patented and dubbed Mack's screws. I rebuke the thing and ignore the designation. The genius of patentism is abroad, and of its oppressive operation upon us as a profession we are sorrowfully reminded by the judicial decision which has been rendered against us within the past twenty-four hours.

A word in regard to the treatment of teeth which have been broken off. I have occasionally adopted the expedients which have been suggested here to-night quite successfully, but I think the process of elongating teeth is eminently proper and practicable, especially among young persons. I believe with Prof. Barker, however, that there is no limitation as to the time when teeth are susceptible to regulation. It takes a longer time to

perform such operations in the adult than in the child, but the same results may be reached in each case. I have known teeth to be elongated in persons thirty or thirty-five years of age. I had one case where the four inferior bicuspids did not erupt, never would have erupted, and the consequence was deformity of the jaw. There was no way to correct the trouble except by elongating these bicuspids, and the only practical method of doing that was to lift them up, which if left to nature would never have been accomplished. By a fixture, which I adjusted so as to operate upon them gradually, they were literally lifted up bodily the whole length of the crown, or nearly so. As they were raised up out of their sockets there was a deposit of osteoplasma formed beneath them, so that they were kept firmly in their places. They are now perfectly firm and solid. Such an operation as this is more difficult in adult age, but is always practicable.

Among the transactions of the Pennsylvania Association of Dental Surgeons we find remarks of Dr. Guilford as follows:

An upper molar, previously filled, had by some accident been split so that the anterior buccal root with its portion of crown had become entirely separated from the other portion. This he filled with amalgam, making the filling bind the broken pieces together. This lasted a year, when the patient returned, and it was found that the tooth had again split, this time each root being separate and movable.

After an examination of the case for five minutes, finding each root loosened by the force of the bite, which severed the roots from each other, he pronounced it incurable. A remark from the patient as to the limited ability of dental art put him on his mettle, and he resolved to attempt the salvation of the tooth. Nothing remained of the crown but three jagged points of enamel and dentine projecting from each root. These he cut off half way to the gum, and beveled off outwardly with a corundum-wheel. With a thin piece of platinum he formed a clasp or ring as great in width as the original height of the crown, which, being soldered and slipped over the projections, bound them together. This ring of platinum was then filled with amalgam and built up until the amalgam antagonized with the opposing tooth, when the case was dismissed for a week. At the end of that time the platinum band was cut off by a circular saw on the dental engine and the surplus material smoothed off, and the tooth to all appearances seems likely to be of service for a long time.

Proceedings of Dental Societies.

ST. LOUIS DENTAL SOCIETY.

OFFICE OF DR. A. H. FULLER,
ST. LOUIS, Feb. 5th, 1878.

FRACTURED TEETH.

DR. C. W. SPALDING:—Patient, a lady forty-five years of age. General health good. Teeth large and strong, of good texture, and well cared for. Called for an examination of a tooth in which she supposed there was a large cavity of decay, as food seemed to collect in it and cause pain. On examination I found the tooth (the right superior bicuspid, with prominent cusps and correspondingly deep fissure), perfectly sound, but with a fracture extending entirely across the crown, from the mesial to the distal surfaces separating the cusps. The fissure was filled with particles of food, which I removed. As my patient would not submit to the extraction of the tooth or any other treatment, I discharged the case, since which time I have not heard from it. I should mention that there was a little mal-articulation of the teeth, the outer cusp of the superior tooth antagonizing with the inner cusp of the lower. There was, therefore, no splitting force exerted by the mode of articulation. The cause of the fracture is, to me, a mystery.

DR. JUDD —I have seen several cases of fractured teeth, the cause of which was somewhat obscure. A lady forty years of age; structure of teeth good; articulation perfect; had the first superior bicuspid fractured, splitting off the lingual cusp, the fracture passing under the gum. The tooth was sound and no cause could be assigned for the accident. I destroyed and removed the nerve, filled the root canals and pulp cavity, rounding up the filling and leaving the tooth in shape like the cuspid. Second case: A lady of thirty; first superior molar, small cavity on mesial surface; fracture extending through the crown leaving the palatine fang attached to the lingual half and the

labial fangs to the opposite part. Removed the tooth, found abscess at the apex of each fang. The patient was totally unconscious of the existence of the fracture, and had no recollection of any accident which had happened to the tooth.

Dr. Fuller :—A lady sixty years of age; good health, and strong, well developed teeth; found upon examination the second superior bicuspid split into two equal parts separating the cusps, and as it proved, the two fangs of the root. Destroyed and removed pulp; treated and filled root canals; passed a bolt through crown, bringing the parts together, then filled. The results thus far very satisfactory. The tooth was alive, perfectly sound, occlusion perfect, and the patient had no knowledge when the accident occurred or how.

CELLULOID.

Dr. Eames :—I am in receipt of a communication from Dr. C. Stoddard Smith, who has recently been engaged by the "Celluloid Manufacturing Co.," to take charge of the dental plate department, requesting me to give him such suggestions as may occur to me in reference to what may or ought to be done to improve celluloid, and do away with any and all objections to its use. He asks the following questions: "Do you use dry heat, or steam, or oil? Do you have any complaints as to discoloration; or from wearing away around the pins; or from warping?" At his request I desire to bring this matter before the Society, and hope the members will give the Dr. such suggestions as may occur to them, to aid him in making celluloid what the profession have long desired.

In reply to Dr. Smith's inquiries, I would state that I am now using a "dry heater," and like it better than the oil or steam which I formerly used. I get uniformly better results, which, perhaps, is due quite as much to my present method of manipulating the base, as to the kind of heater used.

I find that all of my celluloid plates discolor more or less, and this discoloration is a source of complaint with some of my patients. It loses its polish and wears away from the pins in some mouths more rapidly than in others. It seems to soften and disintegrate in some cases, undoubtedly from the action of the secretions or fluids in which it lies. In some cases it will

warp and lose entirely its adaptation to the mouth. In other cases there does not seem to be much change of any kind. I recently met a patient for whom I inserted a full denture (temporary) two years since. His salutation was, "How are you, my benefactor?" On asking an explanation for this expression of his, he replied: "You found me toothless and unable to eat. You supplied me with a set of teeth which you said would answer the purpose as masticators for perhaps a year. I have now worn them two years with the greatest ease and comfort; chew anything and everything I desire as well as I ever could with my natural teeth, and they are as good to-day as they ever were, and it does not seem that they ever will fail." This, I regard, as a successful case of *celluloid*. Rubber would probably have done as well. I do not regard it as being as strong as rubber, and yet it possesses strength sufficient for full sets in most cases. It is too soft for partial sets, especially in cases of isolated teeth; at least I have but little confidence in it in such cases. I use Brown's heater, and like it because it is small and requires but a short time to raise heat sufficient to soften the plate in forming. The process for closing the flask can also be conveniently observed. In the top of the flask is a little cup or reservoir, containing a fusable metal which softens and becomes fluid at the degree of heat required for softening the celluloid; it is therefore used instead of a thermometer, avoiding, thereby, the danger of breaking, to which this instrument is very liable. This metal in the top of one of my flasks having been removed, I trusted to my knowledge of the amount of heat required and formed several cases successfully, with no guide except my judgment in the management of the heat, but becoming over confident and consequently a little careless, I let the heat run too high in one case and set the plate afire. Since then I have used water in the cup as an indicator, with much success. When the water commences to boil I find the material sufficiently softened to admit of the closing of the flask.

DR. FULLER:—Inserted a plate of four teeth; patient complained of a burning sensation in the gums and roof of the mouth. Attributed it to the presence of camphor; advised her to continue to wear the plate, believing that the trouble would disappear in a short time. She wore it

six months with no apparent improvement; substituted a plate of black rubber which has since been worn with perfect comfort and no apparent inflammation or change of tissue. Inserted a plate of Rose-pearl, which soon became worthless on account of the disintegration of the material causing holes in the plate. Have had trouble with the celluloid on account of the change which it seems to undergo in the mouth, causing change of shape and color.

Dr. Spalding :—I use the "dry heater" in forming plates and like it. I believe I obtain as good results as I could by the use of steam or oil heaters, and with less labor. I prefer it because it affords me the opportunity of watching the process of closing the flask. I believe the most frequent cause of unfavorable results with celluloid is the want of sufficient pressure at the last moment of closing the flask. The closing of the flask, when at the right degree of heat, requires but little force until the process is nearly completed, then there should be sufficient material in the mould to require considerable force to close it. In forming my plates, I frequently open the flask towards the end of the process and introduce pieces of sheet tin over the region of the pins to increase the pressure at this point. I thus secure perfect adaptation of the celluloid to the teeth and around the pins, and increased pressure to thoroughly condense the sheet. Celluloid is not as strong as rubber, and I do not think it is as durable.

I am not pleased with the results following the use of either celluloid or rubber. In many cases the wearing of either of these substances produces very unpleasant sensations. In some cases the discomfort is so great that I have substituted metal plates and relief has uniformly followed the change of material.

I have also noticed a more rapid and longer continued absorption of the alveolar processes and ridge, than usually results from the use of gold plates. I think the discomfort and the increased absorption are due to the non-conducting property of the materials.

Dr. Keith :—Dr. Spalding's remarks in regard to the absorption which seemed to follow the wearing of celluloid or rubber plates brings to my mind a suggestion made to me by Mrs. Keith. She suggested that it might be a good plan to have a

dummy plate made to wear immediately after extraction, without teeth, till the parts are healed. If the facts are as stated by Dr. S., why would it not be a good plan to insert a dummy plate of rubber or celluloid to promote absorption?

THE MISSOURI AND KANSAS STATE DENTAL ASSOCIATIONS.

[Continued from last month.]

FRIDAY, JUNE 8, 1877—MORNING SESSION.

The Missouri State Dental Association was called to order by the president, Dr. Bowman, at 8 a. m.

Minutes of last session read and approved.

The treasurer, Dr. Price, made his annual report as follows:

	June 8, 1876.	
Cash on hand	$ 66.15	
Cash received during the year	23.00	
	$89.15	
1877. Received during session	51.00	
	$140.15	
Cr. Bills paid as follows:		
Legislative Committee		$124.70
Paid Price bill		8.25
Executive Committee, Stark		9.50
Executive Committee, Prevost		14.30
		$156.75
Due Dr. Eames salary		25.00
		$181.75
Cash at beginning of session	$ 89.15	
Cash received during the session	51.00	
	$140.15	
Deficit	41.60	
	$181.75	

Dr. Price, chairman of Legislative Committee, made a report as follows :

Kansas City, June 6, 1877.

To the Missouri State Dental Association :

We, your Committee, appointed at the last session of this Association to draft and present to the Legislature a bill regulating the practice of Dentistry in this State, with much mortification, have to state that we, with *much labor, loss of time* and *great expense* in that behalf, presented to the Legislature no less than eight different bills, all of which met an untimely death at the hands of that august body. The eighth and last bill presented was a compromise bill and passed the Senate without opposition and went into the House in good shape, but by the assistance of members of the profession, who opposed the bill, it found its untimely grave in the House.

Your Committee regrets to say, that they did not receive from the members of the profession that support which the subject demanded, and which we expected, and with which our efforts would have been a success. We are forced to the conclusion that the profession in this State are not ready for such legislation. We therefore ask to be discharged. All of which is most respectfully submitted.

James A. Price,
W. H. Eames, } Committee.
S. B. Prevost.

The president, Dr. Bowman, named the following members as clinical operaters for the next annual meeting : J. A. Price, W. H. Eames, Homer Judd, Edgar Park, S. B. Prevost, L. C. Wasson, Thompson, W. N. Morrison.

On motion the secretary was instructed to prepare a certificate of membership and furnish the same to C. Prevost.

Dr. I. D. Pierce, by request, was transferred from the role of active member to that of honorary member.

Executive Committee reported as follows on topics of discussion and names of essayists for the next annual meeting of the Association :

Treatment of Exposed Pulps—Wasson.
Treatment of Pulpless teeth—Schultze.
Mechanical Dentistry—D. J. McMillen.
Irregularity, its cause and treatment—W. N. Morrison.
Dental Education—W. H. Eames.
Dental Literature—H. Judd.
Status of Dentistry—G. A. Bowman.
Cleft Palates—H. H. Keith.
Microscopy and Histology—G. V. Black.
Report concurred in.

The Executive Committee reported that they had seen the

proprietors of the Missouri Dental Journal, and brought to their notice the feeling which existed in the Missouri and Kansas State Associations in regard to the editorial management of the Journal, and the request that some change should be made if consistent with their interest; that Mr. Leslie gave them the assurance that everything should be done that could be, to make the journal acceptable to the profession. This was his desire and he thanked the Association for their calling attention to what was needed of him. Adopted.

A vote of thanks was tendered the Executive Committee for the manner in which they had discharged the arduous duties devolving upon them.

The thanks of the Association was tendered as follows:

Resolved, That the thanks of Kansas and Missouri State Dental Associations are hereby tendered to the Kansas Pacific, A. T. & S. F., M. P., S. L., K. C. & N., W. K. C. & N. W. and K. C., S. J. & C. B. Railroads, and St. James hotel for reduced rates to members attending this meeting.

Thanks were voted to the Odd Fellows.

On motion the transactions of the Association and joint sessions with the Kansas State Association were ordered to be published in book-form. The President and Secretary to co-operate with the officers of the Kansas State Association in getting out the publication, and the cost of publication to be mutual with the Associations. Adopted.

The resolution, as an amendment to By-laws, was offered by Dr. Eames:

Resolved, That no member shall speak more than twice on any question, or for more than five minutes at a time, without special permission of the Association.

Adopted.

A communication from R. F. Hunt, of Washington, D. C., on the status of the new rubber suits now pending, and soliciting aid from the Association for carrying them to a final, and as he believed successful issue, was presented by Dr. W. N. Morrison.

On motion of Dr. Tindall, the communication was received and placed on file.

Dr. Morrison was called upon to conduct the President elect to the Chair.

Dr. Bowman, the retiring President, thanked the Association for the uniform courtesy and generous aid extended to him during his executive term and asked that the same courtesy might be extended to his successor, Dr. Tindall.

Dr. Tindall, on taking the Chair, said briefly that the honor conferred upon him was a surprise, and that in returning his thanks for the honor thus conferred he promised to do all in his

power to add to the general usefulness of the Association by a faithful discharge of his official duties.

Adjourned to meet at Sweet Springs, the first Tuesday in June, 1878.

W. H EAMES, Recording Secretary.

GOLD VERSUS AMALGAM.

The note on the above question in the November issue does not by any means state the matter fairly. Until recently all amalgams have been taken with or without the statement of the makers that they were fit to use, and no test of this fitness for use has been known until within the last four or five years.

Further than this, it has been the almost universal custom to add an excess of mercury and squeeze part of this out (all the excess cannot be removed by any known means). It is well known that this treatment makes any amalgam quite worthless as a filling material.

I might with fully equal justice condemn gold because every plug failed when I had used common gilders leaf and most carefully stuck it in with my finger and thumb, this manner of using being quite as sensible as the ordinary way amalgam is treated.

After examining great numbers of amalgam plugs, some of them having been in the mouth over forty years, it is my firm conviction that if a good amalgam plug fails after having been inserted, it is in every case, without exception, totally and entirely the fault of the operator. If a dentist uses an amalgam with which he cannot obtain good results in theoretical testing, the fault is also his own.

Amalgam has a place in operative dentistry, and fills it well if fairly treated, but if an operator fails for want of proper knowledge of its requirements, surely it is only justice to expend the blame in the proper quarter. THOS. FLETCHER, F. C. S.

[The objections urged by the writer in the above article are well taken. The cause for failure of amalgam fillings in many cases may undoubtedly be traced to the use of worthless material, or to the faulty manipulation of a good one, but there is a case

occasionally in which the failure cannot be so clearly assigned to either of the above causes. Take for instance the following: A patient had six amalgam fillings inserted in the proximal surfaces of the incisors; they *all leaked badly*, and were removed and gold substituted. The material used in this case was an alloy of gold and tin which the maker, an honorable member of the profession, who has spent much time and labor in experimentation with amalgams, assures us NEVER leaks; its manufacture is his personal work, and every ingot is thoroughly tested for shrinkage; hence the fault in this case could not have been the material used. Was it properly manipulated? Certainly, for the work was done by one of the leading amalgam operators of this country; a man who prides himself on knowing just how amalgam filling should be done, and always doing it as it should be; a man who is recognized as an honorable, conscientious and capable operator. Will Mr. Fletcher tell us what was the cause of failure in this case.—E.]

Obituary.

PROF. GEO. T. BARKER.

At a meeting composed of the members of the Odontological Society of New York, and its invited guests, held on January 15, 1878, to pass resolutions relative to the death of Prof. GEO. T. BARKER, of Philadelphia.

Dr. Lord was, on motion of Dr. Ambler, made President.

Drs. Francis, Dwinelle, Perry, Ambler and Bronson were appointed a committee, which, on motion of Dr. Jarvis, was instructed to publish the resolutions and the minutes of the meeting in the dental journals, and to send a copy to the family of the deceased, and to the faculty of the Pennsylvania College of Dental Surgery. E. A. BOGUE, Secretary.

The Committee, therefore, in according with the above instructions, respectfully present the following:

WHEREAS, Learning with deep regret and sorrow of the death

of our friend and professional brother, Professor GEO. T. BARKER, of Philadelphia, in the prime of his manhood and of his usefulness to the dental profession and to humanity; therefore,

Resolved, That we appreciate the upright, conscientious and earnest services of Prof. BARKER, and remember with feelings of gratitude and admiration his eminent ability, his untiring research, and his candid and generous action in all matters pertaining to the world of professional thought and investigation.

Resolved, That our regret for his untimely decease is lightened by the remembrance that his services to dentistry will insure that his name and memory will always occupy an honorable and distinguished place among those of our profession whom we all delight to honor.

Resolved, That our sympathies, true and heartfelt, are hereby tendered to the family, relatives and friends of the deceased, in this sad and inscrutable dispensation of Divine Providence.

Resolved, That we tender to the Faculty of the Pennsylvania College of Dental Surgery an expression of our deep sense of the loss they have sustained in the death of him, who has been so long associated with the institution and its interests.

CHAS. E. FRANCIS,
WM. H. DWINELLE,
S. G. PERRY,
J. G. AMBLER,
WM. A. BRONSON,
} Committee.

GEO. J. BARCLAY.

Dr. GEO. J. BARCLAY, of Pittsburgh, Pa., died suddenly of internal hemorrhage on the morning of the 22nd of January, 0:15 o'clock, at the residence of Dr. W. H. Atkinson, New York city, in the 53rd year of his age. Dr. BARCLAY was a skillful operator, and especially kind and courteous with his patients. The dental profession can ill afford to lose such members and his death will be generally regretted.

CELLULOID.

CELLULOID MANUFACTURING CO.,
NEWARK, N. J., 1878.

TO THE EDITOR MISSOURI DENTAL JOURNAL:

The Celluloid Manufacturing Company, now that the suits in regard to the infringement of the Cummings patent have been definitely settled in their favor, thus securing to dentists the right o use the celluloid base without molestation, have determined to

devote more attention to the Dental Department of their business. They have engaged the services of the undersigned, who will make it his business, as well to answer all inquiries, as to improve the celluloid base in its application to dentistry. They will be pleased to receive suggestions from any quarter, and to reply to any questions that may be asked.

Every suggestion that appears to be valuable will be put to a practical test, and such as prove so will be made use of.

Several styles of plates not generally in use are now for sale, and other forms will soon be prepared. Attention is called at present to the following as not generally known: "A" plates, shapes and sizes the same as the ordinary uppers, but nearly double in thickness, for cases where much absorption has taken place; "plumper" plates, four sizes (uppers) with very heavy rim, as indicated by the name, and a new style of partial plates (two sizes, 7 and 8), for cases where only the front teeth are to be replaced. These are all very useful plates, and should be in the hands of every dentist who uses celluloid, in working which it is important to have a plate of the proper size and shape at hand. If dentists cannot obtain these plates from the depots, orders sent direct to the factory will be filled through Dr. Sam'l S. White, sole agent for the sale of the same.

A further improvement in the forms of plates is contemplated, due notice of which will be given. There is also in preparation a little pamphlet containing revised instructions, testimonials, etc., and descriptions and cuts of the plates, a copy of which, when issued, will be furnished on application.

The superiority of celluloid over rubber in many if not all respects, is now acknowledged by those who have made the most extensive use of it.

The Celluloid Manufacturing Company is in possession of testimonials, from those who have used it to the extent of hundreds of plates, during periods extending over five or six years, certifying to its being more satisfactory to both dentist and patient. It is less heating to the gums, free from injurious ingredients and far more pleasant and cleanly, both to manufacture and wear, besides being infinitely preferable in appearance. The use of plain teeth enables the dentist to give a far more life-like and natural expression to the features than is possible with gum sections. The undersigned may be addressed as above and will be pleased to answer any inquiries. C. STODDARD SMITH.

CHANGE OF PUBLISHERS.

Messrs. A. M. Leslie & Co. will, on March 1st, 1878, resume control of THE MISSOURI DENTAL JOURNAL. From that date all business communications should be addressed to the above firm.

GEO. O. RUMBOLD & CO.

THE MISSOURI

DENTAL JOURNAL,

A MONTHLY RECORD OF MEDICAL SCIENCE.

VOL. X.——MARCH, 1878.——No. 3.

SPONTANEOUS GENERATION.

BY PROF. JOHN TYNDALL, F. R. S.

I.

Within ten minutes' walk of a little cottage which I have recently built in the Alps, there is a small lake, fed by the melted snows of the upper mountains. During the early weeks of summer no trace of life is to be discerned in this water; but invariably toward the end of July, or the beginning of August, swarms of tailed organisms are seen enjoying the sun's warmth along the shallow margins of the lake, and rushing with audible patter into the deeper water at the approach of danger. The origin of this periodic crowd of living things is by no means obvious. For years I had never noticed in the lake either an adult frog, or the smallest fragment of frog spawn; so that, were I not otherwise informed, I should have found the conclusion of Mathiole a natural one, namely, that tadpoles are generated in lake-mud by the vivifying action of the sun.

The checks which experience alone can furnish being absent, the spontaneous generation of creatures quite as high as the frog in the scale of being was assumed for ages to be a fact. Here, as

elsewhere, the dominant mind of Aristotle stamped its notions on the world at large. For nearly twenty centuries after him men found no difficulty in believing in cases of spontaneous generation which would now be rejected as monstrous by the most fanatical supporter of the doctrine. Shell-fish of all kinds were considered to be without parental origin. Eels were supposed to spring spontaneously from the fat ooze of the Nile. Caterpillars were the spontaneous products of the leaves on which they fed, while winged insects, serpents, rats and mice, were all thought capable of being generated without sexual intervention.

The most copious source of this life without an ancestry was putrefying flesh, and, lacking the checks imposed by fuller investigation, the conclusion that flesh possesses and exerts this generative power is a natural one. I well remember when a child of ten or twelve seeing a joint of imperfectly salted beef cut into, and coils of maggots laid bare within the mass. Without a moment's hesitation I jumped to the conclusion that these maggots had been spontaneously generated in the meat. I had no knowledge which could qualify or oppose this conclusion, and for the time it was irresistible. The childhood of the individual typifies that of the race, and the belief here enunciated was that of the world for nearly two thousand years.

To the examination of this very point the celebrated Francesco Redi, physician to the Grand-dukes Ferdinand II. and Cosmo III. of Tuscany, and a member of the Academy del Cimento, addressed himself in 1668. He had seen the maggots of putrefying flesh, and reflected on their possible origin. But he was not content with mere reflection, nor with the theoretic guess-work which his predecessors had founded upon their imperfect observations. Watching meat during its passage from freshness to decay, prior to the appearance of maggots he invariably observed flies buzzing round the meat and frequently alighting on it. The maggots, he thought, might be the half-developed progeny of these flies.

The inductive guess precedes experiment, by which, however it must be finally tested. Redi knew this, and acted accordingly Placing fresh meat in a jar and covering the mouth with paper, he found that though the meat putrefied in the ordinary way, it never bred maggots, while the same meat placed in open jars soon

swarmed with these organisms. For the paper cover he then substituted fine gauze, through which the odor of the meat could rise. Over it the flies buzzed, and on it they laid their eggs, but, the meshes being too small to permit the eggs to fall through, no maggots were generated in the meat. They were, on the contrary, hatched upon the gauze. By a series of such experiments Redi destroyed the belief in the spontaneous generation of maggots in meat, and with it doubtless many related beliefs. The combat was continued by Vallisneri, Schwammerdam, and Réaumur, who succeeded in banishing the notion of spontaneous generation from the scientiffic minds of their day. Indeed, as regards such complex organisms as those which form the subject of their researches, the notion was banished forever.

But the discovery and improvement of the microscope, though giving a death-blow to much that had been previously written and believed regarding spontaneous generation, brought also into view a world of life formed of individuals so minute—so close as it seemed to the ultimate particles of matter—as to suggest an easy passage from atoms to organism. Animal and vegetable infusions exposed to the air were found clouded and crowded with creatures far beyond the reach of unaided vision, but perfectly visible to an eye strengthened by the microscope. With reference to their origin these organisms were called "infusoria." Stagnant pools were found full of them, and the obvious difficulty of assigning a germinal origin to existences so minute furnished the precise condition necessary to give new play to the notion of heterogenesis or spontaneous generation.

The scientific world was soon divided into two hostile camps, the leaders of which alone can here be briefly alluded to. On the one side we have Buffon and Needham, the former postulating his "organic molecules," and the latter assuming the existence of a special "vegetative force" which drew the molecules together so as to form living things. On the other side we have the celebrated Abbé Lazzaro Spallanzani, who in 1877 published results counter to those announced by Needham in 1748, and obtained by methods so precise as to completely overthrow the convictions based upon the labors of his predecessor. Charging his flasks with organic infusions, he sealed their necks with the blow-pipe, subjected them in this condition to the heat of boiling

water, and subsequently exposed them to temperatures favorable to the development of life. The infusions continued unchanged for months, and when the flasks were subsequently opened no trace of life was found.

Here I may forestall matters so far as to say that the success of Spallanzani's experiments depended wholly on the locality in which he worked. The air around him must have been free from the more obdurate infusorial germs, for otherwise the process he followed would, as was long afterward proved by Wyman, have infallibly yielded life. But his refutation of the doctrine of spontaneous generation is not the less valid on this account. Nor is it in any way upset by the fact that others in repeating his experiments obtained life when he obtained none. Rather is the refutation strengthened by such differences. Given two experimenters equally skillful and equally careful, operating in different places on the same infusions, in the same way, and assuming the one to obtain life while the other fails to obtain it; then its well-established absence in the case proves that some ingredient foreign to the infusion must be its cause in the other.

Spallanzani's sealed flasks contained but small quantities of air, and as oxygen was afterward shown to be generally essential to life, it was thought that the absence of life observed by Spallanzani might have been due to the lack of this vitalizing gas. To dissipate this doubt, Schulze in 1836 half-filled a flask with distilled water, to which animal and vegitable matters were added. First boiling his infusion to destroy whatever life it might contain, Schulze sucked daily into his flask air which had passed through a series of bulbs containing concentrated sulphuric acid, where all germs of life suspended in the air were supposed to be destroyed. From May to August this process was continued without any development of infusorial life.

Here, again, the success of Schulze was due to his working in comparatively pure air, but even in such air his experiment is a very risky one. Germs will pass, unwetted and unscathed, through sulphuric acid, unless the most special care is taken to detain them. I have repeatedly failed, by repeating Schulze's experiments, to obtain his results. Others have failed likewise. The air passes in bubbles through the bulbs, and, to render the

method secure, the passage of the air must be so slow as to cause the whole of its floating matter, even to the core of each bubble, to touch the surrounding liquid. But, if this precaution be observed, water will be found quite as effectual as sulphuric acid. By the aid of an air-pump, in a highly-infective atmosphere, I have thus drawn air for weeks without intermission, first through bulbs containing water, and afterward through vessels containing organic infusions, without any appearance of life. The germs were not killed, but they were effectually intercepted, while the objection that the air had been injured by being brought into contact with strongly corrosive substances was avoided.

The brief paper of Schulze, published in Poggendorf's *Annalen* for 1836, was followed in 1837 by another short and pregnant communication by Schwann. Redi, as we have seen, traced the maggots of putrefying flesh to the eggs of flies. But he did not and he could not know the meaning of putrefaction itself. He had not the instrumental means to inform him that *it* also is a phenomenon attendant on the development of life. This was first proved in the paper now alluded to. Schwann placed flesh in a flask filled to one-third of its capacity with water, sterilized the flask by boiling, and then supplied it for months with calcined air. Throught this time "there appeared no mould, no infusoria, no putrefaction; the flesh remained unaltered, while the liquid continued as clear as it was immediately after boiling." Schwann then varied his experimental argument, with no alteration in the result. His final conclusion was, that putrefaction is due to decompositions of organic matter attendant on the multiplication therein of minute organisms. These organisms were derived not from the air, but from something contained in the air, which was destroyed by a sufficiently high temperature. There never was a more determined opponent of the doctrine of spontaneous generation than Schwann, though a strange attempt was made a year and a half ago to enlist him and others equally opposed to it on the side of the doctrine.

The physical character of the agent which produces putrefaction was further revealed by Helmholtz in 1843. By means of a membrane he separated a sterilized putrescible liquid from a putrefying one. The sterilized infusion remained perfectly intact. Hence it was not the liquid of the putrefying mass—for it

could freely diffuse through the membrane—but something contained in the liquid, and which was stopped by the membrane, that caused the putrefaction. In 1854 Schroeder and Von Dusch struck into this inquiry, which was subsequently followed up by Schroeder alone. These able experimenters employed plugs of cotton-wool to filter the air supplied to their infusions. Fed with such air, in the great majority of cases the putrescible liquids remained perfectly sweet after boiling. Milk formed a conspicuous exception to the general rule. It putrefied after boiling, though supplied with carefully-filtered air. The researches of Schroeder bring us up to the year 1859.

In that year a book was published which seemed to overturn some of the best established facts of previous investigators. Its title was "Hétérogénie," and its author was F. A. Pouchet, Director of the Museum of Natural History at Rouen. Ardent, laborious, learned, full not only of scientific but of metaphysical fervor, he threw his whole energy into the inquiry. Never did a subject require the exercise of the cold, critical faculty more than this one—calm study in the unraveling of complex phenomena, care in the preparation of experiments, care in their execution, skillful variation of conditions, and incessant questioning of results, until repetition had placed them beyond doubt or question. To a man of Pouchet's temperament, the subject was full of danger—danger not lessened by the theoretic bias with which he approached it. This is revealed by the opening words of his preface: "Lorsque, par la méditation, il fut évident pour moi que la génération spontanée était encore l'un des moyens qu'emploie la nature pour la reproduction des êtres, je m'appliquai à découvrir par quels procédés on pouvait parvenir à en mettre les phénomènes on évidence." It is needless to say that such a prepossession required a strong curb. Pouchet repeated the experiments of Schulze and Schwann with results diametrically opposed to theirs. He heaped experiment upon experiment, and argument upon argument, spicing with the sarcasm of the advocate the logic of the man of science. In view of the multitudes required to produce the observed results, he ridiculed the assumption of atmospheric germs. This was one of his strongest points. "Si les Proto-organismes que nous voyons pulluler partout et dans tout, avaient leurs germes disséminés dans l'atmos-

phère, dans la proportion mathématiquement indispensable à cet effet, l'air en serait totalement obscurci, car ils deravient s'y trouver beaucoup plus serrés que les globules d'eau qui forment nos nuages épais. Il n'y a pas là la moindre exagération." Recurring to the subject, he exclaims, "L'air dans lequel nous vivons aurait presque la densité du fer." There is often a virulent contagion in a confident tone, and this hardihood of argumentative assertion was sure to influence minds swayed not by knowledge, but by authority. Had Pouchet known that "the blue ethereal sky" is formed of suspended particles, through which the sun freely shines, he would hardly have ventured upon this line of argument.

Pouchet's pursuit of this inquiry strengthened the conviction with which he began it, and landed him in downright credulity in the end. I do not question his ability as an observer, but the inquiry needed a diciplined experimenter. This latter implies not mere ability to look at things as Nature offers them to our inspection, but to force her to show herself under conditions prescribed by the experimenter himself. Here Pouchet lacked the necessary discipline. Yet the vigor of his onset raised clouds of doubt, which for a time obscured the whole field of inquiry. So difficult indeed did the subject seem, and so incapable of definite solution, that when Pasteur made known his intention to take it up, his friends Biot and Dumas expressed their regret, earnestly exhorting him to set a definite and rigid limit to the time he purposed spending in this apparently unprofitable field.[1]

Schooled by his education as a chemist, and by special researches on the closely related question of fermentation, Pasteur took up this subject under particularly favorable conditions. His work and his culture had given strength and finish to his natural aptitudes. In 1862, accordingly, he published a paper "On the Organized Corpuscles existing in the Atmosphere," which must forever remain classical. By the most ingenious devices he collected the floating particles of the air surrounding his labora-

1. "Je ne conseillerais à personne," said Dumas to his already famous pupil, "de rester trop longtemps dans ce sujet."—"Annales de Chemie et de Physique," 1862, vol. lxiv., p. 22.) Since that time the illustrious Perpetual Secretary of the Academy of Sciences has had good reason to revise this "counsel."

tory in the Rue d'Ulm, and subjected them to microscopic examination. Many of them he found to be organized particles. Sowing them in sterilized infusions, he obtained abundant crops of microscopic organisms. By more refined methods he repeated and confirmed the experiments of Schwann, which had been contested by Pouchet, Montegazza, Joly, and Musset. He also confirmed the experiments of Schroeder and Von Dusch. He showed that the cause which communicated life to his infusions was not uniformly diffused through the air; that there were aërial interspaces which possessed no power to generate life. Standing on the Mer de Glace, near the Montanvert, he snipped off the ends of a number of hermetically sealed flasks containing organic infusions. One out of twenty of the flasks thus supplied with glacier air showed signs of life afterward, while eight out of twenty of the same infusions, supplied with the air of the plains, became crowded with life. He took his flasks into the caves under the Observatory of Paris, and found the still air in these caves devoid of generative power. These and other experiments, carried out with a severity perfectly obvious to the instructed scientific reader, and accompanied by a logic equally severe, restored the conviction that, even in these lower reaches of the scale of being, life does not appear without the operation of antecedent life.

The main position of Pasteur, though often assailed, has never yet been shaken. It has, on the contrary, been strengthened by practical researches of the most momentous kind. He has applied the knowledge won from his inquiries to the preservation of wine and beer, to the manufacture of vinegar, to the staying of the plague which threatened utter destruction to the silk-husbandry of France, and to the examination of other formidable diseases which assail the higher animals, including man. His relation to the improvements which Prof. Lister has introduced into surgery is shown by a letter quoted in his "Etudes sur la Bière."[1] Prof. Lister there expressly thanks Pasteur for having given him the only principle which could have conducted the antiseptic system to a successful issue. The strictures regarding Pasteur's defects of reasoning, to which we have been

1. P. 43.

lately accustomed, delivered with a tone of supercilious contempt, where reverent teachableness would have been the fitting state of mind, throw abundant light upon their author, but none upon Pasteur.

Redi, as we have seen, proved the maggots of putrefying flesh to be derived from the eggs of flies; Schwann proved putrefaction itself to be the concomitant of far lower forms of life than those dealt with by Redi. Our knowledge here, as elsewhere connected with this subject, has been vastly extended by Prof. Cohn, of Breslau. "No putrefaction," he says, "can occur in a nitrogenous substance if its bacteria be destroyed and new ones prevented from entering it. Putrefaction begins as soon as bacteria, even in the smallest numbers, are admitted either accidentally or purposely. It progresses in direct proportion to the multiplication of the bacteria, it is retarded when they exhibit low vitality, and is stopped by all influences which either hinder their development or kill them. All bactericidal media are therfore antiseptic and disinfecting."[2] It was these organisms acting in wound and abscess which so frequently converted our hospitals into charnel-houses, and it is their destruction by the antiseptic system that now renders justifiable operations which no surgeon would have attempted a few years ago. The gain is immense—to the practicing surgeon as well as to the patient practiced upon. Contrast the anxiety of never feeling sure whether the most brilliant operation might not be rendered nugatory by the access of a few particles of unseen hospital-dust, with the comfort derived from the knowledge that all power of mischief on the part of such dust has been surely and certainly annihilated. But the action of living contagia extends beyond the domain of the surgeon. The power of reproduction and indefinite self-multiplication which is characteristic of living things, coupled with the undeviating fact of contagia "breeding true," has given strength and consistency to a belief long entertained by

2. In his last excellent memoir, Cohn expresses himself thus: "Wer noch heut die Fäulniss von einer spontanen Dissociation der Proteinmolecule, oder von einem unorganisirten Ferment ableitet, oder gar aus 'Stickstoffsplittern' die Balken zur Stutze seiner Fäulnisstheorie zu zimmern verucht, hat zuerst den Satz 'keine Fäulniss ohne Bacterium Termo' zu widerlegen."

penetrating minds that epidemic diseases generally are the concomitants of parasitic life. "There begins to be faintly visible to us a vast and destructive laboratory of Nature wherein the diseases which are most fatal to animal life, and the changes to which dead organic matter is passively liable, appear bound together by what must at least be called a very close analogy of causation."[1] According to this view, which, as I have said, is daily gaining converts, a contagious disease may be defined as a conflict between the person smitten by it and a specific organism which multiplies at his expense, appropriating his air and moisture, disintegrating his tissues, or poisoning him by the decompositions incident to its growth.

During the ten years extending from 1859 to 1869, researches on radiant heat in its relations to the gaseous form of matter occupied my continual attention. When air was experimented on, I had to cleanse it effectually of floating matter, and, while doing so, I was surprised to notice that, at the ordinary rate of transfer, such matter passsed freely through alkalies, acids, alcohols, and ethers. The eye being kept sensitive by darkness, a concentrated beam of light was found to be a most searching test for suspended matter both in water and in air—a test indeed indefinitely more searching and severe than that furnished by the most powerful microscope. With the aid of such a beam I examined air filtered by cotton-wood, air long kept free from agitation, so as to allow the floating matter to subside, calcined air, and air filtered by the deeper cells of the human lungs. In all cases the correspondence between my experiments and those of Schroeder, Pasteur, and Lister, in regard to spontaneous generation, was perfect. The air which they found inoperative was proved by the luminous beam to be optically pure and therefore germless. Having worked at the subject both by experiment and reflection, on Friday evening, the 21st of January, 1870, I brought it before the members of the Royal Institution. Two or three months subsequently, for sufficient practical reasons, I ventured to direct public attention to the subject in a letter to the *Times*. Such was my first contact with this important question.

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1. "Report of the Medical Officer of the Privy Council." 1874. p. 5.

This letter, I believe, gave occasion for the first public utterance of Dr. Bastian in relation to this question. He did me the honor to inform me, as others had informed Pasteur, that the subject "pertains to the biologist and physician." He expressed "amazement" at my reasoning, and warned me that before what I had done could be undone "much irreparable mischief might be occasioned." With far less preliminary experience to guide and warn him, Dr. Bastian was far bolder than Pouchet in his experiments, and far more adventurous in his conclusions. With organ infusion he obtained the results of his celebrated predecessor, but he did far more— the atoms and molecules of inorganic liquids passing under his manipulation into those more "complex chemical compounds" which we dignify by calling them "living organisms."[1] For five years, or thereabouts, Dr. Bastian ploughed the field without impediment from me, and, now that one can overlook the work, I am bound in truth to say that very wonderful ploughing it has been. As regards the public who take an interest in such things, and apparently also as regards a large portion of the medical profession, he certainly succeeded in restoring the subject to a state of uncertainty similar to that which followed the publication of Pouchet's volume in 1859.

It is desirable that uncertainty should be removed from the public mind, and doubly desirable on practical grounds that it should be removed from the minds of medical men. In the present article, therefore, I propose discussing this question face to face with some eminent and fair-minded member of the medical profession who, as regard spontaneous generation, entertains views adverse to mine. Such a one it would be easy to name; but it is perhaps better to rest in the impersonal. I shall therefore simply call my proposed co-inquirer my friend. With him at my side I shall endeavor, to the best of my abiliiy, so to conduct this discussion that he who runs may read, and that he who reads may understand.

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1. "It is further held that bacteria or allied organisms are prone to be engendered as correlative products, coming into existence in the several fermentations, just as independently as other less complex chemical compounds."—(Bastian, "Transactions of the Pathological Society," vol. xxvi., p. 258.)

Let us begin at the beginning. I ask my friend to step into the laboratory of the Royal Institution, where I place before him a basin of thin turnip-slices barely covered with distilled water kept at a temperature of 120° Fahr. After digesting the turnip for four or five hours we pour off the liquid, boil it, filter it, and obtain an infusion as clear as filtered drinking water. We cool the infusion, test its specific gravity, and find it be 1006 or higher—water being 1000. A number of small, clean, long empty flasks, is required, with long, slim nozzles, which are bent so as form an angle with the body of the flask, somewhat less than a right angle. One of them is slightly warmed with a spirit-lamp, and its open end is then dipped into the turnip infusion. The warmed glass is afterward chilled, the air within the flasks cools, contracts, and is followed in its contraction by the infusion. Thus we get a small quntity of liquid into the flask. We now heat this liquid carefully. Steam is produced, which issues from the open neck, carrying the air of the flask along with it. After a few seconds' ebullition, the open neck is again plunged into the infusion. The steam within the flask condenses, the liquid enters to supply its place, and in this way we fill our little flask to about four-fifths of its volume. This description is typical; we may thus fill a thousand flasks with a thousand different infusions.

I now ask my friend to notice a trough made of sheet-copper, with two rows of handy little Bunsen burners underneath it. This trough, or bath, is nearly filled with oil; a piece of thin plank constitutes a kind of lid for the oil bath. The wood is perforated with circular apertures wide enough to allow our small flask to pass through and plunge itself in the oil, which has been heated, say, to 250° Fahr. Clasped all around by the hot liquid, the infusion in the flask rises to its boiling-point, which is not sensibly over 212° Fahr. Steam issues from the open neck of the flask and the boiling is continued for five minutes. With a pair of small brass tongs an assistant now seizes the neck near its junction with the flask, and partially lifts the latter out of the oil. The steam does not cease to issue, but its violence is abated. With a second pair of tongs held in one hand, the neck of the flask is seized close to its open end, while with the other hand a Bunsen's flame or an ordinary spirit-flame is brought under the

middle of the neck. The glass reddens, whitens, softens, and as it is gently drawn out the neck diminishes in diameter until the canal is completely blocked up. The tongs with the fragment of severed neck being withdrawn, the flask, with its contents diminished by evaporation, is lifted from the oil-bath perfectly sealed hermetically.

Sixty such flasks filled, boiled, and sealed, in the manner described, and containing strong infusions of beef, mutton, turnip, and cucumber, are carefully placed in sawdust and ransported to the Alps. Thither, to an elevation of about 7,000 feet above the sea, I invite my co-inquirer to accompany me. It is the month of July, and the weather is favorable to putrefaction. We open our box at the Bel-Alp, and count out fifty-four flasks, with their liquids as clear as filtered drinking water. In six flasks, however, the infusion is found muddy. We closely examine these, and discover that every one of them has had its fragile end broken off in the transit from London. Air has entered the flasks, and the observed muddiness is the result. My colleague knows as well I do what this means. Examined with a pocket-lens, or even with a microscope of insufficient power, nothing is seen in the muddy liquid; but regarded with a magnifying power of a thousand diameters or so, what an astonishing appearance does it present? Leeuwenhoek estimated the population of a single drop of stagnant water at 500,000,000; probably the population of a drop of our turbid infusion would be this many times multiplied. The field of the microscope is crowded with organisms, some wabbling slowly, others shooting rapidly across the microscopic field. They dart hither and thither like a rain of minute projectiles; they pirouette and spin so quickly round, that the retention of the retinal impression transforms the little living rod into a twirling wheel. And yet the most celebrated naturalists tells us that they are vegetables. From the rod-like shape which they so frequently assume, these organisms are called bacteria—a term, be it here remarked, which covers organisms of very diverse kinds.

Has this multitudinous life been spontaneously generated in these six flasks, or is it the progeny of living germinal matter carried into the flasks by the entering air? If the infusions have a self-generative power, how are the sterility and conse-

quent clearness of the fifty-four uninjured flasks to be accounted for? My colleague may urge—and fairly urge—that the assumption of germinal matter is by no means necessary; that the air itself may be the one thing needed to wake up the dormant infusions. We will examine this point immediately. But I would meanwhile remind my friend that I am working on the exact lines laid down by our most conspicuous heterogenist. He distinctly affirms that the withdrawal of the atmospheric pressure above the infusion favors the production of organisms; and he accounts for their absence in tins of preserved meat, fruit, and vegetable, by the hypothesis that fermentation *has* begun in such tins, that gases *have* been generated, the pressure of which has stifled the incipient life and stopped its further development.[1] This is Dr. Bastian's theory of preserved meats. Its author has never, to my knowledge, pierced a tin of preserved meat, fruit, or vegetable, under water with a view of testing its truth. Had he done so, he would have found it erroneous. In well preserved tins I have invariably found, not an outrush of gas, but an inrush of water, when the tin is perforated. I have noticed this recently in tins which have lain perfectly good for sixty-three years in the Royal Institution. Modern tins, subjected to the same test, yielded the same result. From time to time, moreover, during the last two years, I have placed glass tubes, containing clear infusions of turnip, hay, beef, and mutton, in iron bottles, and subjected them to air pressures, varying from ten to twenty-seven atmospheres—pressures, it is needless to say, far more than sufficient to tear a preserved meat tin to shreds. After ten days these infusions were taken from their bottles rotten with putrefaction and teeming with life. Thus collapses an hypothesis which had no rational foundation, and which could never have seen the light had the slightest attempt been made to verify it.

Our fifty-four vacuous and pellucid flasks also declare against this heterogenist. We expose them to a warm Alpine sun by day, and at night we suspend them in a warm kitchen. Four of them have been accidentally broken; but at the end of a month we find the fifty remaining ones as clear as at the commence-

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1. "Beginnings of Life," vol. i., p. 418.

ment. There is no sign of putrefaction or of life in any of them. We divide these flasks into two groups of twenty-three and twenty-seven respectively (an accident of counting rendered the division uneven). The question now is whether the admission of air can liberate any generative energy in the infusions. Our next experiment will answer this question and something more. We carry the flasks to a hay loft, and there, with a pair of steel pliers, snip off the sealed ends of the group of twenty-three. Each snipping-off is of course followed by an inrush of air. We now carry our twenty-seven flasks, our pliers, and a spirit-lamp, to a ledge overlooking the Aletsch glacier, about two hundred feet above the hay loft, from which ledge the mountain falls almost precipitously to the northeast for about a thousand feet. A gentle wind blows toward us from the northeast—that is, across the crests and snow fields of the Oberland mountains. We are, therefore, bathed by air which must have been for a good while out of practical contact with either animal or vegetable life. I stand carefully to leeward of the flasks, for no dust or particle from my clothes or body must be blown toward them. An assistant ignites the spirit-lamp, into the flame of which I plunge the pliers, thereby destroying all attached germs or organisms. Then I snip off the sealed end of the flask. Prior to every snipping the same process is gone through, no flask being opened without the previous cleansing of the pliers by the flame. In this way we charge our twenty-seven flasks with clean vivifying mountain air.

We place the fifty flasks, with their necks open, over a kitchen stove, in a temperature varying from 50° to 90° Fahr., and in three days we find twenty-one out of the twenty-three flasks opened on the hay loft invaded by organisms—two only of the group remaining free from them. After three weeks' exposure to precisely the same conditions, not one of the twenty-seven flasks opened in free air had given way. No germ from the kitchen air had ascended the narrow necks, the flasks being shaped to produce this result. They are still in the Alps, as clear, I doubt not, and as free from life as they were when sent off from London.[1]

1. An actual experiment made three months ago at the Bel-Alp is here described.

What is my colleague's conclusion from the experiment before us? Twenty-seven putrescible infusions, first *in vacuo*, and afterward supplied with the most invigorating air, have shown no signs of putrefaction or of life. And as to the others, I almost shrink from asking him whether they hay loft has rendered them spontaneously generative. Is not the inference here imperative that it is not the air of the loft—which is connected through a constantly open door with the general atmosphere—but something contained in the air, that has produced the effects observed? What is this something? A sunbeam glinting through a chink in the roof or wall, and traversing the air of the loft, would show it to be laden with suspended dust particles. Indeed, the dust is distinctly visible in the diffused daylight. Can *it* have been the origin of the observed life? If so, we are not bound by all antecedent experience to regard these fruitful particles as the germs of the life observed?

The name of Baron Liebig has been constantly mixed up with these discussions. "We have," it is said, "his authority for assuming that dead decaying matter can produce fermentation." True, but with Liebig fermentation was by no means synonymous with *life*. It will be observed, by the careful reader of Dr. Bastian's works, that whenever their author refers to this alleged power of decaying matter, he invariably couples with it the vague term "fermentation," thus softening the shock of the hypothesis which he insinuates rather than asserts. But our present intention is to brush all vagueness aside. We therefore ask, "Does *the life* of our flasks proceed from dead particles?" If my co-inquirer should reply "Yes," then I would ask him: "What warrant does Nature offer for such an assumption? Where, amid the multitude of vtial phenomena, in which her operations have been clearly traced, is the slightest countenance given to the notion that the sowing of dead particles can produce a living crop?" With regard to Baron Liebig, had he studied the revelations of the microscope in relation to these questions, a mind so penetrating could never have missed the significance of the facts revealed. He, however, neglected the microscope, and fell into error—but not into error so gross as that in support of which his authority has been invoked. Were he now alive, he would, I doubt not, repudiate the use often

made of his name—Liebig's view of fermentation was at least a scientific one, founded on profound conceptions of molecular instability. But this view by no means involves the notion that the planting of dead particles—"Stickstoffsplittern," as Cohn contemptuously calls them—is followed by the sprouting of infusorial life.—*Popular Science Monthly.*

GENESIS.—II.

BY HIRAM CHRISTOPHER, M. D.

I am not unmindful of the fact that we should be modest and cautious when speaking of the possibilities and impossibilities of science. It has accomplished such wonders, and achieved so much that was apparently impossible in these late years, that some men are disposed to believe that it is well-nigh omnipotent —that nothing is impossible to it. Nevertheless, we may still hazard the belief that some things are indeed impossible to it, and will ever be. We may certainly venture to deny it *creative* power. It cannot show us that something can be generated from nothing, and thereby convince us that phenomena have not an efficient and adequate cause. Its field is the actual, not the possible. Reason may consider the latter, but science must deal with facts. These it may investigate and classify; but it cannot predict the possible only as this may be seen, or conjectured as dependent on what is actually observed and known.

All claims of science should be based on fact or reason. They should be rational. Anything unreasonable or absurd, as our reason may esteem it, unless a fact, should be regarded as unscientific. Men may, and have claimed, in the name of science, what was unreasonable—what was not warranted by facts, but science was not pledged by the claim. Science follows facts, and is guided by reason, and hence is guilty of no absurdity what-

ever. Though a few men have affirmed that physical phenomena have the same basis and origin as the physical, and say that the conclusion is sustained by facts; that the latest achievements of science point in this direction, and to this conclusion; yet we know from the denial of others, equally competent and scientific, that the statement has no scientific course; that it is but the doctrine of those who seem to wish to see phenomena is this light. The best that can be said for such a claim is that it is an *inference* and not a necessary one either. That mind was latent in "the cosmic vapor" may be an inference apparently required by numerous facts; but it cannot be proved. It can never be more than an inference, and not a rational one either. Its proof is simply impossible.

It is not much encouragement to the acceptance of such an hypothesis to know that it rests on the assumption that matter and its forces are eternal, an assumption made from necessity and for the occasion. The hypothesis also assumes the identity of the vital with the physical force. This school holds and teaches that there is no categorical or specific difference between the vital and physical force, and none between psychical and physical phenomena. They believe that mind was once latent in "the fiery mist," in which form matter once appeared; and that it is possible to predict, from a knowledge of matter and its forces, the ultimate outcome of molecular action; that "from a knowledge of the properties of the molecules of that cosmic vapor, a sufficient intelligence could have predicted, say the state of the fauna of Brittain in 1869, *with as much certainty as* any one can say will happen to the vapor of the breath in a cold winter day." Now as the fauna of Brittain contained, in 1869, many species which displayed very high psychical faculties and phenomena, Mr. Huxley would have us believe that these faculties and phenomena result entirely and exclusively from the molecular arrangement the molecules of the cosmic vapor came finally to assume, under the operation of a force that is inherent in them —the relation in which they are found in animals possessing psychical faculties, and exhibiting psychical phenomena. It might be thought immodest to characterize such a notion as absurd and visionary in the extreme; but it would be none the less so, if a thousand Huxleys were to affirm it. If the hypothesis

were true, we ought to find one unbroken series of phenomena, stretching from the beginning to the present, each member resting on, or proceeding from, its immediate predecessor, in such a way, and to such an extent, that the latter was always evolved from the former. If such an unbroken series does not exist, and has not existed, and cannot be shown to have existed, then the hypothesis is without foundation in fact or reason. Of this assumption Agassiz says: "The supposition that all animals constitute one continuous, graduated series can be shown to be contrary to nature; that in proportion as our knowledge of the true affinities of animals is improving, we accumulate more and more convincing evidence *against* the idea that the animal kingdom constitutes one simple series." That we should follow Agassiz and not Huxley, as the true exponent of the facts of nature involved in this question, will appear evident as we proceed.

What is matter to which so great a power is attributed by the cosmic vapor school of scientists? It is much easier to ask the question than to answer it. What *it is* we need not care to know. We know that much is visible and tanglible, and that all is possessed of certain properties. Some material substances are invisible; but we are satisfied of their existence by the phenomena they present. Such are some of the elementary gases. We know them, and distinguish them by their properties, and by these are just as fully assured of their existence as though they were visible and tangible. Matter is not a unit, except as an abstract conception. It is multiform, and of many kinds, and its elements inconvertible the one into another. Lead is not copper, nor is iron gold, nor can the one be transmuted into the other. They may not all have been *created* at the same time, unless such was the pleasure of the *creator*. But if matter had no creator—if it is, in fact, eternal as to its existence, then all material substances are equally eternal. We would have, in that event, as many eternal entities as we have simple elements; and if all things now existing owe their being to matter as their potential cause, we have as many creators as elements, and, consequently, as many Gods. Thus would these cosmic vapor scientists give us many gods for the one *Great God* they would deprive us of! When we ask them for a fish, they give us a stone!

But confessedly matter can do nothing without its forces.

There could be no iron, or phosphorous, or any other purely material substance in our bodies if it were not for the force of chemical affinity. There could be no material compounds in nature, but for this force. Are the physical forces inherent in matter, or distinct and separable from matter? If the latter, then we must add to the number of the material deities! But it matters not, so far as the question under consideration is concerned, whether they are inherent or distinct. We know that matter is utterly impotent without them. The imponderable agents are really the active forces concerned in the production of physical phenomena. Without these the elementary substances would have continued forever in their simple state. There could have been no combination one with another. The power, then, which these scientists ascribe to matter, should be really ascribed to the forces of the physical world. These are only material because connected with matter. Chemical affinity, heat, light, etc., have none of the common properties of matter. We know they exist. Some we can see and feel, and others we know from their phenomena. This evidence of their entity or existence is satisfactory, and, indeed, unquestioned. The school of modern scientists admits all this. The admission will be found useful to the cause of true science, and hurtful to the false. These forces are subtle; yet we know that they exist. They may be entities, and not mere habits or phenomena of matter. They are, at least, constant, if not inherent. They are not a form of matter, for they have none of its properties. Their existence, therefore, suggests the possibility of the existence of other subtle agents or powers which are still farther removed from the substantial nature of matter, and afford us standing ground for believing in another force, even more subtle than physical forces. The vital force may be such a different force. Its phenomena are different, if not differential. Chemical affinity may give rise to heat, or light, or electricity, and we might admit its convertibility into these, under certain conditions or circumstances; but neither of these are trnsmuted into the vital, nor the vital into either of them. This will appear evident further along, when we find the vital force associated with *will* power.

There is, confessedly, no spontaneity in matter or its forces. They are all wholly passive. They remain at absolute rest or

equilibrium, unless acted on by a force from without. How, then, can they give origin to anything? Their inertia makes this impossible. The movement of the atoms of matter is produced by a power really external or foreign to them. All the changes that they undergo, take place under the influence and action of their forces; and all the changes that they are capable of effecting, are the measure of the power of physical forces. Under the same conditions the action of physical agents is always the same. The same effects are always produced by the same causes. Chemical affinity will form of iron and other substances numerous combinations; but always the same body with the same substances in the same quantity and under the same conditions. What physical forces can effect will be effected, and that readily and invariably when the necessary conditions are present. What is beyond their power must be ascribed to a supernatural power. Of this there cannot be the slightest doubt.

What, then, is the limit of the power and action of physical forces? If there be a phenomenon which they cannot produce, the existence of that phenomenon must be ascribed to a power specifically different from any and all physical agents. The changes effected in material substances by physical agents are indeed, wonderful; but however great, the formed bodies never lose their material properties. We can readily tell that they are still purely material substances, though the change is from the solid to the gaseous state. There are, indeed, no traces of iron in its sulphate, nor of zinc in its chloride. The salts present no trace of the elements that compose them. The same is true as regards crystals. The crystal of an element is wholly unlike that of its salts. These are great and wonderful changes which physical forces work with the elements of matter; but they are so common and easily produced, that they excite no surprise in those who know anything of the causes and properties of the substances, which effect the changes. Crystals, acids, bases, salts, and neutral bodies are really the limits of the changes in matter which physical forces can effect. In the inorganic world their work is always on the same plane; but chemical changes in organic bodies are, with but few exceptions, in a downward direction—from the organic to the inorganic; never in an upward direction, on the plane of the living organism or its products.

On the other hand, it is universally admitted that all the work of the vital force is in an upward direction. It forms living organisms out of dead matter. It imparts motion to that which is at rest and cannot move of itself. In the organisms which it forms, it gives rise to phenomena which are unknown and impossible to the most complex bodies of the inorganic world. Its work has placed an impassable gulf between the organic and inorganic kingdoms of nature. No work of physical agents is found within its field, and none of it in that of physical forces. These facts cannot be explained on any hypothesis that does not recognize the specific nature of the vital agent. Their nature and phenomena are the poles apart.

It is to the vital force, as the cause, that living organisms are ascribed even by the modern scientist. The error of this school lies in its misconception of the *nature* and *realm* of this force; in denying to it an existence that is *pro*natural, and a nature that is *super*natural, and a mode of operation that is specifically different from that of any other force or agent known to science. If it has no specific power over the elements and atoms of matter different from that of chemical affinity, it ought to be as much under the control of the chemist as is chemical affinity, or other physical forces. There are but few combinations of matter found in the inorganic world, which the chemist cannot effect or reproduce. He can also crystalize many simple and compound substances, destroy them, and then reform them. The crystal can be destroyed by heat, and the salt by decomposing agents; but the chemist can again place the metal under proper conditions for crystalizing, and reproduce the salt by removing the decomposing agents. These are familiar phenomena, and hence excite no surprise. But if he were to revive the dead organism and set all its organs in motion again, our surprise would be so great that we might cry out, "The gods have come down to us in the likeness of men." If the vital agent were but a physical force men ought to do this. But they neither revive a dead organism, nor make a living one. They cannot even make "formed matter," which is non-living organic matter. And why not, if the living organism is only an advance on the crystal, as the crystal is an advance on the same substance in amorphous form? If this were really a fact, then the production of living organ-

isms should not only be possible, but as common in the chemist's laboratory as are crystals and salts. But the fact that living organisms are impossible to any agency which men may employ, is proof that the life agent is not a physical force, nor under the control of the scientist in any degree. Every force or agency under the control of man has been put to the utmost test in the hope that living organisms may come into being through its operation. But there has been no response but the silence of death. Spontaneous generation is still a dream. The atoms of matter will not assume a vital relation except under the power of the life agent. The dream of spontaneous generation is the dream of an abnormal mind or heart.

When we bring an acid and a base together under proper condition, we find that they readily combine, and form a body very much unlike either. If we bring the chloride of barium and the sulphate of soda together in solution, a complex change of atoms takes place. How they are arranged in the new salts we cannot tell. Whatever may be the complexity of atomic combination in the most complex salts, we know that the result is only material salt—that there is no organism in this complexity. If the atomic combination of the most complex salt, were a thousand times more complex than it is, the result would be only material salt. In such changes and combinations the atoms of matter make these changes and form these combinations under the influence of chemical affinity. They are determined by the chemical force. Their motion in assuming new relations is not spontaneous. They have no will, and hence no spontaneity. Nor is the action of the chemical force spontaneous. It must act when substances, having affinity for each other, are brought together under proper conditions. The positve and negative poles of a battery are not more attracted. As positive electricity attracts the negative, so do substances by virtue of their chemical affinity. The one cannot resist the other, so as to resist the union. Their union is a necessity, not a spontaneity. Hence, all that the chemist can do in the work of chemical combinations, is to place substances, having an affinity for each other, under the proper and necessary conditions. He cannot determine the relations the atoms shall assume in the new combinations; and chemical affinity does this, whatever this may be. The

union of atoms can be prevented only by destroying the proper and necessary conditions. Hence, if we expose iron to moist air, an oxide will be formed; if zinc to dilute sulphuric acid, a sulphate will be formed, and not something else. This result cannot be prevented, except in the way stated. But if we bring together carbonic acid and water in every way possible to the chemist, he cannot make them unite so as to form any one of the ternary compounds— either sugar, gum, starch or cellulose. Much less can he hope to create living matter, or a living organism in which alone these ternary bodies are formed.

The production of compounds, of the series of organic bodies just bordering on the confines of the inorganic world, has been accomplished by the direct method,but they belong to that series of organic bodies which are produced by the decomposition of ternary or quarternary compounds. But higher than this the chemist has not gone. The experiments that have been made in the interest of spontaneous generation, have all been made with organic matter; and even under this favorable circumstance or condition—an advantage to which the investigator was not entitled—success has failed to crown the most patient, persistent, and protracted efforts. Spontaneous generation is yet an impossibility, and will ever prove to be so. Prof. Tyndall says that spontaneous generation is yet unrealized. "Is there no experimental proof of spontaneous generation? I answer without hesitation—none." The fact is that the wish is father to the hope, and the inspiration of all efforts in this direction. Fact and reason are against any such a hope or expectation. The utter impossibility could have been inferred had the reasoning and procedure been scientific. The method of inquiry that ignores, disregards, or excludes certain phenomena, as common and as familiar as the formation of salts, cannot be regarded as rational and scientific. Had the pursuers of this *ignis fatuus* began with man and gone back to the microscopic organism, instead of beginning with the latter and going toward the former, they would have discovered, before experimenting, that it is impossible to assign the psychical phenomena of man or of the lower animals to a purely physical origin or base. They would have seen in the development, and gradually increasing manifestation, of the power that imparted spontaneity of motion, and the power of growth and reproduc-

tion to living matter or the living organism, as this development and psychical manifestation appears in man, the true nature of the life-giving power. In him psychical phenomena are displayed in such a degree and of such a character as to point to their true nature, origin and basis. One would have supposed that the greatness and sweep of man's psychical powers would at once have forbidden all hope of success of any effort made to prove a physical basis for vital phenomena. Nevertheless, some scientists, even after repeated failures, still declare their belief that mind has no basis different from that of salts and crytals; that it is but a function of organized matter, as the medical properties of a salt are of it. Yet these scientists smile at the simplicity and credulity of the man who dreams of perpetual motion—a dream no more irrational nor impossible than spontaneous generation. Men who have struggled with the problem of spontaneous generation, look with compassion on the dreaming enthusiast, whilst they themselves are laboring on as wild a dream. They tell the misguided man that his dream is impossible, and his labors a waste of time and energy. Yet the hope of the former is just as rational as that of the latter; and I am at a loss to understand why the scientist is to be regarded as rational in his pursuit, while the dreamer of a perpetual motion is to be put down as a simpleton. The scientist has no advantage; for to believe that mind of every degree, and genius of every kind, were potential or latent in the forces of "cosmic vapor," "or the fires of the sun," is unreason just on the borders of insanity.—*St. Louis Medical and Surgical Journal.*

OPERATIVE DENTISTRY.*

BY GEO. H. CUSHING.

Your committee do not propose, at this time, to go over the ground which has been so fully covered by recent reports on this department, but to endeavor to lay before you in a concise manner the present status of operative dentistry. The outlook is a somewhat peculiar one—certainly claims serious attention, and cannot fail to afford much food for thought.

It is hardly necessary to state that for several years last past there has been a very strong feeling among the better men of the profession, that the results of many operations on the teeth, particularly those performed upon the proximal sides of bicuspids and molars, were not proving as successful as had been hoped, or, perhaps, as had been the case during former years. This naturally led to inquiry into the causes of this condition of things, and various theories were advanced intended to satisfactorily explain (to the minds of the authors thereof,) this generally recognized phenomenon. Some claimed that this was simply the result of faulty operations. Were this the case, a remedy could hardly be hoped for, as these conditions are observed among men whose skill is far above the average of our best men, taken as a class; for though such criticism implies the possibility of such perfection of operating as to render such failures impossible, yet the facts go to show that such skill rests with so very few men that practically it is unavailable for the benefit of the patients of most of the profession. Others, again, claimed that such failures were due to the use of cohesive gold, and suggested, of course, as the remedy, a return to non-cohesive or (so-called) soft gold. That this is not a satisfactory explanation, would appear from the fact that many of those observing these unfortunate results in their practice during the few years last past, had not experienced any such misfortunes in the years preceding, though using cohesive gold exclusively during both periods.

*Report of the Committee on Operative Dentistry.—Transactions of the American Dental Association, 1877.

Again, it was claimed that the gold was over-malleted, especially at the cervical margins. This undoubtedly explains a part of the failures, yet it can hardly cover all. Last of all comes the "Electro-Chemical" theory as a full explanation of the whole matter. Thus far the advocates of this theory have failed to furnish any proofs of its truth. Experiments out of the mouth do not establish anything as occurring within that cavity, and yet so important did it seem, to arrive at some solution to the question "why such failures were so common," and so unsatisfactory had been all previous explanations, that the profession hoped that the truth had been reached at last, and some were inclined to act upon the suggestion springing from the discussions upon this theory; but more mature thought probably convinced the majority, that there was not any satisfactory ground as yet established upon which to base a new departure in this direction.

In connection with this subject we have observed that a great deal has been said during this period in favor of tin as a better material than gold for preserving the teeth. Among the older practitioners particularly, this is true, and many seem to think there is some chemical influence exerted which tends to preserve teeth filled with tin. However that may be, the fact is quite apparent that very many have the strongest conviction of the superiority of tin over any other metal or substance of any kind, and some in consequence of that belief, have used it in certain cases for filling over cervical margins, completing the operation with gold. Your committee are not aware of any conserative effect of any filling for carious teeth other than that secured by perfect exclusion of air and moisture from the cavity of decay, and if it is true that tin serves as a better protection than anything else, it is probably due to the fact that it can more easily be manipulated to produce air andmoisture-tight margins than any other material, though it may be impossible for us to demonstrate the fact.

Your committee have endeavored to obtain as reliable information as possible in relation to the present position of the profession on the points suggested by the foregoing remarks. This information has come from a somewhat extended correspondence with representative men in various sections of the

country, and also from quite an extended personal exchange of views, and, as a result of such information, the following conclusions are reached:

1st. That the use of tin in combination with gold, as suggested by the discussions of the theory of "electro-chemical action," advocated by Dr. S. B. Palmer, has been resorted to to a very limited extent. It, the tin, would seem to have been used by few operators, chiefly as a covering and protection for the cervical walls of proximal cavities, the balance of the filling being completed with gold. Some of these have evidently used it because of their old time belief in its value over other materials for filling, without attempting to explain the reason of its superiority; others, again, have used it—experimentally—simply because it had been suggested; while some few, doubtless having faith in Palmer's theory, believe they see a scientific reason for its use in this manner.

2nd. The use of amalgam has largely increased during the two or three years last past, and more particularly among men of high repute. From fifty-five communications upon this subject, thirty-six express the opinion that there has been an increase in its use by the better class of operators; some say a large increase, others a perceptible one. But five say there is no increase, while but one says it is on the decrease. The balance of the fifty-five either express no opinion or else a very vague one. This increased use of amalgam may be ascribed to various causes. The experiments of Bogue, Hitchcock, Cutler, and others, invited a more serious attention to the subject of amalgams than had before been given to it; and, co-incidently with these experiments and the discussions arising therefrom, a great improvement in the character of the alloys offered for sale, led those who had formerly used but little, to enlarge their use of it very considerably and many men to make use of amalgam who had never before tried it. Many of these commenced its use experimentally, without any reasoning upon the subject, except that gold failed to accomplish what was sought, and they were ready to try amalgam because others attested to its superiority; others, again, commenced its use, or used more than formerly, because convinced by the reasoning of Dr. Palmer and others that it was more compatible with tooth structure than gold. Others, again,

were actuated by some of the above reasons, and an added one of the necessity of using something which should be less expensive than gold, owing to the pressure of the hard times. These reasons doubtless were the actuating influence with honest practitioners, and have no reference to that class who seize upon the example and teaching of prominent men as warrant for a more enlarged use of a material that they had never used either properly, intelligently or honestly; with that class this report has nothing to do.

3d. The use of non-cohesive gold has largely increased during the period under consideration, and seems to be still increasing; this especially for application to the margins of cavities, and most particularly to the cervical walls. Its use would seem to be, as a rule, in connection with cohesive or semi-cohesive gold, which is used for completing operations. As the use of non-cohesive gold increases, so does a return to hand pressure in part supplant the use of the mallet. Reference was made in the report on this subject, read before this Association at Detroit, to the tendency observed then to return to old methods. The evidence upon which this report is based goes to show that such tendency is on the increase. Also in the matter of cutting away the teeth with reference to securing permanent separations, the weight of testimony shows an increased tendency in that direction; not to the carrying out of Dr. Arthur's system, but to the establishment of a conservative system of part cutting away, and partial restoration of contour. While we find some who still adhere rigidly to the idea of restoring contour in all cases, and others, again, who insist upon the widest separation, yet the rule would seem to be the following of a conservative and eclectic plan, endeavoring to judiciously adapt the treatment to the requirements of the case.

Thus it would seem from the testimony, to be clearly the fact that operative dentistry to-day occupies more than ever before a conservative position; that is, not running to either extreme in methods as a rule, and making its practice generally eclectic. This, in one sense, clearly is an advance, and would seem to augur well for the future of the profession, but unless this eclecticism is based on sound philosophy it must be in part delusion; and it would certainly seem to be a pertinent inquiry,

upon what is this observed modification (change,) of practice based. Is this return to the use of non-cohesive gold the result of any positive evidence in its favor, or of the negative evidence against the cohesive gold, or is it in part or mainly to be attributed to the desire to render operations more speedy and easy of accomplishment? The solution of this question would seem to be a difficult one, because of the many and diverse elements necessarily entering into its consideration. If we are told that the fillings of non-cohesive gold inserted thirty, forty, and even fifty years ago, are doing good service to-day, and that they furnish ample evidence in favor of that material, we are met on the other hand by the statement that the teeth of earlier generations were of a better character than those which we operate upon to-day, and that we of to-day undertake to preserve a class of teeth that by our predecessors were invariably consigned to the forceps; so that it cannot be said that we have any proof that is convincing. The same remarks are equally applicable to amalgam, and perhaps to tin. Again, in taking such cases of long standing, old-fashioned fillings, as evidence on one side, we entirely ignore the lost evidence on the other side, which departed with very many of that same class of fillings: How many such proved failures, who can tell? And who can say that very many of the fillings of co-hesive gold inserted to-day, will not be standing equally well with the above referred to, thirty, forty, or fifty years hence? The data upon which to base a scientific conclusion seem here altogether inadequate. The convictions of individuals not based upon demonstrable facts, or long tried experience, may be sufficient authority for the individual, but they can form no sound basis for any scientific mode of practice to be formulated for the profession generally. Of course it must be apparent to all that in the nature of the case a successful mode of practice in operative dentistry can only be formulated from a comparison of results of experiences of long duration, of different methods pursued by honest observers who shall have kept careful records of the results of all their operations. Have we any such basis now to work upon? Are we not, then, standing upon somewhat uncertain ground? Can we give a reason for the faith that is in us? We have in our ranks a few extremists who contend that nothing should be used for

filling teeth but gold, and that of a certain kind, and after a certain method; and, on the other hand, a few may be found who urge the abolition of gold, and a resort to amalgam for filling all cavities—some very prominent gentlemen and teachers going so far as to say that the "coming dentist is to be a plastic man." Is it possible that these can advance any scientific basis for their claims? Should not, then, the thoughtful consideration of the present position of operative dentistry inspire us to a greater earnestness, and to the pursuit of more thorough and well considered methods of investigation, in order that the reproach may be removed which has been cast upon us, "that knowledge has to wait upon assumption and dogmatic opinion?"

In concluding this report your committee would venture to suggest their convictions as to that which is needed in view of what has been here said, and they cannot do so in any better manner than by quoting, as expressing their sentiments in concise and forcible manner, the language of one of their communications upon this subject: "What we most need in 'Operative Dentistry' is a well-digested method of teaching, under the administration of honest, capable, enthusiastic teachers, who shall not be dependent upon the pupils whom they instruct, for their salaries, nor have to earn their living by general practice in their own offices. * * * One or two really good institutions, endowed so as to be independent of pupil patronage" is the great need of the present time.

"THE NEW DEPARTURE."

BY CHARLES E. FRANCIS, D. D. S., NEW YORK.

According to an old saying,—"to every individual specimen of the canine race is alloted a day of license," so every theory has "its day," and with members of our fraternity every method of practice also. We must keep up some sort of agitation all the time, in order to avoid stagnation. We enjoy excitement, and like to stir up a breeze,—blow a little ourselves, and listen with eager delight to others while they blow. Our societies, in order to keep up an interest in their meetings, *must* have subjects for discussion, and our journals must furnish such food as will tickle the intellectual palates of their readers. As new theories are propounded, we approve or dissent as reason suggests or prejudice disposes; we commend or condemn, *or*, perhaps, in regular order, do both!

The "sixth-year molars" have witnessed a perilous career, their walls having been beset at every vulnerable point. "Contour fillings" have beheld the glory of their conquests, or, through treachery of supposed supporters, have felt the collapse of their coronal brilliancy. "Exposed dental pulps" have passed seasons of therapeutic tillage, and "gold" fevers of every name have had their "run" and braved their dangers. Every question, in any way relating to the science and art of dentistry, has been thoroughly discussed, every subject well ventilated; from "Alpha to Omega" the entire list has passed the most trying ordeal; pen and tongue, the keenest of weapons, have put forth their best endeavors; and one might well suppose that nothing further could be said or written. But we have no new fields to conquor, so we return to old ones which we imagine have not been effectually subdued, and again renew the combat. We were not born to rest, so our old "dogs" must be brought to the front again for further "drill and inspection."

Well, what agony is now prominently before us? The "new departure," of course! The "Chase" has become exciting; th

"Flagg" is flying at top-mast! But somebody says that "there is nothing new under the sun," not even "plastic stoppings." If, however, as some suppose, the term "new departure" signifies total abstinence from the use of gold, then indeed has a *new* and exceedingly strange doctrine been promulgated,—a "departure" seemingly suggested by a biased mind, or by mistaken observations of real practical results. Hundreds of the most experienced and worthy members of our specialty have born witness to the value of the "precious metal" as a filling material, and by their operations have proved the efficiency of the "punching" process. We are not ready to believe that even the most zealous advocates of plastic stoppings condemn "in toto" the use of gold. We do believe, however, that they state many substantial facts regarding the indiscriminate use of this material, and trust that the warnings they utter may be heeded by those who decry every other material for stopping carious teeth. One-idea men are not always the safest guides. Better is it to study principles, examine theories, observe conditions, test methods, and then compare results. Following this course will tend to make us eclectic in practice, consequently better able to meet emergencies, and make our operations of greater value to those for whom they are performed. It should not be taken for granted that plastic stoppings are always stoppings of *amalgam*, although when under the heat of discussion they all seem to fuse into this material. Amalgam is indeed a wonderful substance,—so soft and pliable, so easily manipulated! No wonder it possesses such a fascinating charm to a perplexed and wearied operator when a most difficult and trying case suggests its use. But amalgam possesses peculiar characteristics, constantly giving surprises in divers ways. Sometimes it tends to preserve even the merest fragments of teeth in a remarkable manner, and in other cases, where the same degree of care is used in its manipulation, it proves treacherous and worthless. Perhaps no one material is more extensively used for filling teeth; certainly none is more *misused* or worse abused.

It has been asserted, and by more than one individual, that a certain popular dental society has so greatly encouraged the use of amalgam that the demand for it has been very greatly increased. Societies, as such, are not apt to commit themselves to any special course of practice, and the society referred to has

certainly never done so. Opinions expressed by individuals in society gatherings, or published in our magazines, can be credited to those only who uttered them. It may be well to observe that radical sentiments, though honestly entertained, and earnestly stated, are not unfrequently modified or wholly retracted as the vision becomes clearer and the mind better illuminated.

The late and much-esteemed Dr. Elisha Townsend, who has been quoted altogether too much or *too little*, was for a time considered quite an advocate for amalgam fillings. Subsequently he advised that it be resorted to only in cases where no other material could be employed; and, finally, he retracted all that he had previously stated regarding the merit of this substance and abandoned its use altogether. Sometimes people seem to lose their balance, leaning too much this way or that, and in either case are in danger of falling. Better keep a level head and a firm footing, directed by sound reason and unbiased judgment, instead of being blinded by caprice or impelled by petty dogmatism.—*Cosmos.*

CHARLATANRY IN DESTRUCTIVE DISEASES.

BY C. G. COMEGYS.

When the religious press opens its columns to the advertisements and paid laudations of practitioners who employ secret remedies, it seems to me to be participating in one of the grossest frauds of modern civilization. I say religious press, for secular papers, being regarded as newspapers, are not so fully credited, are not so influential, especially with the religious public, as the religious presses are. The secular press is not held to such strict accountability as the former. But even for the former there is a class of advertisements forbidden by law, because they give publicity to infamous employments. A lottery, even, cannot be advertised without a penalty, because of its fraudulent workings.

The publishers of the religious press exculpate themselves from participating in the wrong of advertising the cures of charlatans by saying that they are not responsible for the truth or value of the thing noticed. If this be sound doctrine, the theater, circus, and every other amusement may be given currency in a religious journal. Indeed, the religious press can get double price for this class of advertisements, for their pious readers behold it as a *quasi* indorsement; and it is because of this implied recommendation that cancer and consumption doctors patronize religious papers so assiduously.

What is the nature of an advertisement of a secret remedy for cancer and consumption? Let us see. A cancer is the most terrible of all diseases to which the human flesh is liable. It pervades the whole earth, attacking the poor, the rich, both sexes alike. Its development in any one is a horror. Its *cure*, therefore, by any remedy or system of practice, would be a boon of incalculable value. To discover a remedy and promulgate it would be one of the grandest performances of man. Such an achievement would cover the whole life of such a man with the benediction of suffering humanity—load him with rewards, and "gild his sepulcher and embalm his name." It would answer, in short, all the powerful instincts we possess of pity, mercy, honor, wealth and fame. Like Jenner's renown, it would grow with the age.

From the knowledge we possess of human instincts and practice to relieve suffering and even danger, periling, as men do, health and life in such divine acts, we have no hesitation in asserting that no human being, acquiring either by laborious research, or by purchase, or in any way, a method of curing a cancer or any destructive disease, *could keep so fearful a secret.* He must publish it to the whole race as an act of mercy and love; his human heart would not permit him to do otherwise. There is but one excuse for the man who could conceal so important a secret, and that is that he is a *moral idiot!* No, the *claim* of so invaluable a secret remedy is a positive proof that it is a gross fraud, for only a fiend could keep it.

But the cancer doctor has an excuse, and it is this: "Am I not entitled to the reward of my discovery and skill, like any other inventor or creator of useful knowledge? If I tell my

method and teach it broadcast, it would give every one the same opportunity, and people would not come to me from a distance—come to *me* as the great cancer (or consumption) doctor."

The creator of a book has a copyright, but the book is sold everywhere, and any one can read it. The inventor of a machine has a patent, and gets a royalty. There is no secret, however, in these cases; all can get the benefit by purchase at their own doors; it is not necessary for the people who have need of these things to go at great expense to a distant place to obtain them. Now, I will admit that a remedy disclosed, and the practice with it, cannot be treated exactly as the question of the book or the machine; but this I can can say, that if any man has a remedy, and knows its application cures cancer, will go to the capitals of nations—Christian or pagan—he can obtain for the disclosure and demonstration millions of money, and honors and titles of distinction beside. No, it is impossible to urge the money question as a reason for keeping the dread secret. How, then, can a man demand what it is impossible to accomplish, namely, that people from remote places must come to him for treatment? I repeat, the pretense of a secret cure is a tacit confession of fraud in a moral sense.

From all who think that they have received any benefit by the prescriptions of these charlatans, certificates are obtained, which are published; generally they are untruthful, unless the disease for which they had been treated was simple in its character. But how many, who have been cheated and robbed, go away in silence and despair, and nothing is heard of their disappointment.

I have now sufficiently shown, I trust, that the self-assumed possessors of cures of cancer and consumption violate the common instincts of humanity, whether represented by love of money, pity, benevolence, honor or fame; all of which are immeasurably more gratified by publicity of methods of treatment than by their concealment. And I therefore reassert, without a fear of successful contradiction, that all those who assume, or participate in the assumption, that a secret cure for cancer or consumption exists, are parties to the basest fraud of modern times.

Finally, when it is announced that such a charlatan has been

a regular physician, and is a graduate of a regular medical school, it is an attempt to cover his nefarious practices with the endorsement of a humane and self-sacrificing profession—one that abhors such secrets—one that perils itself in the face of pestilence and war to aid suffering; and every honest school, when its title to honor has become degraded by one who announces the possession of a secret remedy for the cure of a dire disease, and refuses to disclose it, hastens to erase his name from its honorable enrollment, and his profession spews him out of its mouth.—*American Practitioner.*

NITROUS OXIDE GAS—IS IT DANGEROUS?

BY I. P. WILSON.

I am asked the above question by my patients almost daily. A few years ago I administered gas almost without anxiety and without fear, but of late years I have felt quite differently. I give it now to those only who *insist* upon taking it, and then I feel a degree of solicitude while administering it, lest my patient be the one among twenty or thirty thousands, whose heart shall cease its pulsations *forever*.

I confess, therefore, that I experience a sense of relief when a patient of mine has recovered from the effects of this, or any other anæsthetic, and gone home in safety. Some will doubtless ask how I know that my patient has gone home in safety? Does recovery from the anæsthetic insure freedom from subsequent danger?

Anticipating this question, I would say that I am inclined to think the danger immediate and not remote. We have positive proof of the one; we have not proof of the other. Dr. Waterman, of New York, speaks thus of one of his fatal cases: "She was a perfectly healthy woman before the inhalation, and her disease began right after it." As well might he have attributed

the last hearty meal his patient partook of before the disease began, as being the cause of her death. It is not strange that where tens of thousands of persons are taking anæsthetics all over the land, that some of them have died in a few weeks or few months after the inhalation. A man may boast of good health to-day, and realize to-morrow, for the first time, that he is diseased, and that death is near at hand.

A dentist told me a few years ago of a gentleman who called at his office for the purpose of having a tooth extracted, and wished gas administered. He was told that the tooth was loose, and would extract easily and that there was no need of his taking an anæsthetic for so simple an operation. With some difficulty he was prevailed upon to have the operation performed without the gas. The following morning this man was found dead in his bed. Had he have taken gas and recovered from it,(?) then died so soon afterwards, the case would probably have been reported thus: "Death from nitrous oxide."

But when I took my pencil I only intended reporting the following case in practice, viz: Some time since a man about twenty-two or three years of age called to have some teeth extracted, and wanted gas. The young man was apparently in good health, and I administered the gas without thinking of unusual danger. He had emptied about half the contents of the rubber bag that accompanies the nitrous oxide cylinder of Johnston Brothers, when I noticed from his breathing, the usual pallor of countenance, and the blueness of lips, that my patient had passed almost immediateley under the influence of the gas. I seized a pair of forceps and was about to operate, when his face suddenly became livid, respiration ceased, and violent convulsions followed. I hurriedly placed him upon the floor and resorted to artificial respiration. The convulsions soon subsided, leaving him in a state of coma, with frothing at the mouth. Consciousnes did not return for some time—possibly half an hour, and it was difficult to arouse his memory sufficiently to learn who he was and from whence he came. At length, however, he was able to tell me his town, and I had barely time to get him to the depot for his train. In thinking the matter over after he had gone, I concluded that the case was one of epilepsy. A few weeks later I met my patient on the street, and on in-

quiry learned that he had before, on two or three occasions, fallen to the ground with the same disease.

In conclusion I have but this to say, that a perfectly safe anæsthetic has not yet been found; and were I intending to take an anæsthetic myself I should feel a little like doing as I do when I take a day's journey by railroad—take a one day's policy on my life for about ten thousand dollars.

DENTAL CHART.

BY G. V. BLACK, OF JACKSONVILLE, ILL.

RIGHT SIDE.								LEFT SIDE.							
8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
H	G	F	E	D	C	B	A	A	B	C	D	E	F	G	H

In the above dental chart, the upper teeth are numbered from one to eight—numbering each way from the median line, from the incisor to the wisdom tooth. The lower teeth are represented in the same way by letters from A to H. I use the charts in making examinations for recording the fillings found in the mouth according to their positions.

A curve above a figure or below a letter represents a buccal or labial filling; a curve below a figure or above a letter represents a lingual or palatine filling; a curve on the the mesial or distal side, represents a filling in that surface; a small circle denotes a grinding surface filling. If placed on the mesial side it denotes the anterior pit; if on destal side, a posterior pit, used in the molars and bicuspids; the cutting edges if used in the incisors. Fillings that are leaking are marked with L; those decaying around the magins with Dec. or D; amalgams with Amal. and cc. I bind the charts together in book form with paper fasteners, for convenience in use.

As the relative value of different materials for fillings is now being discussed, I append a table comprising the results of examinations made in the usual run of practice since January 1, 1878, embracing 457 gold fillings and 102 amalgam fillings. I have thought it a matter of importance that the time fillings have served as a protection against decay be noted, and have in all cases endeavored to obtain their history. As the noting of both position and time would take too much space, the positions are omitted:

TABLE.

FILLINGS.	2 Years.	3 Years.	4 Years.	5 Years.	6 Years.	7 Years.	8 Years.	9 Years.	10 to 15 Years.	15 to 20 Years.	20 to 30 Years.	30 Years or more.	Totals	
Good Gold Fillings.....	6	9	4	23	10	23	33	63	186	45	11	11	424	
Failing Gold Fillings...	2		2	3		2	3	1	6	6	5	3	33	457
Good Amalgams..... ...	8			3	2	2	4	3	8	8	1		37	
Failing Amalgams.....		8	9	4	9	11	10	1	11		2		65	102
														559

I do not consider that it is enough to say that so many fillings are good, and so many have failed, without reference to the time they have served as a protection against decay.

The time is the important factor. I have not tabulated any filling of less than two years standing, for the reason that no filling will fail in less time, unless it be the result of an accident or carelessness on the part of the operator. I am not certain but that the time should be extended to three or four years, in order to rule out the results of accidents and grossly bungled operations, neither of which have any place in estimating the real value of materials. The amalgam fillings given as failing in the three-year column of the table, I am satisfied were very imperfectly made. They were all in one mouth, and made at one sitting. The same remark applies to five of those in the four-year column. The great majority of the fillings recorded in this table have evidently been excellent operations. The great majority of the amalgams were made by the same operators who made the gold fillings.

RECORDING FILLINGS.

The recording of fillings for future reference is a matter of

no slight importance, and should on no account be neglected by any operator. It is, therefore, a matter of no inconsiderable importance that every operator should find and adopt a plan of record, that will in the shortest space practicable give him a complete and perfect record. It would also be a matter of no little convenience if the profession could agree upon a plan that could be universally adopted. Such a plan would necessarily be applicable to any form of book, and wholly within the grasp of every operator. The plan I have long been using, it seems to me would answer that purpose, as it is quite perfect —easily understood and employed—may be used in any book, as it requires no especial form. This plan is based upon the numbering and lettering of the above chart, the figures representing the upper teeth, and the letters the lower, in the form there given. I use these figures and letters independent of the chart. Throw it aside entirely and use each individual letter or figure alone, or, two or more together as the case may require, to represent the tooth or teeth represented in the chart, and designate the side to which it or they belong, by a line representing the median line, drawn beside the figure or letter used; and as the teeth are represented facing me, as two persons face to face, the sides are reversed thus; 6| would represent the right superior molar; |4 would represent the first left superior bicuspid; G| would represent the second right inferior molar, etc. To represent fillings or surfaces filled, I use the same curves spoken of above in the use of the charts, thus: (2)| would represent the right superior lateral incisor, with mesial and distal fillings; (6o| would represent the first, right superior molar, with distal filling and grinding surface filling in anterior pit, etc. Farther illustration seems unnecessary. Any ordinary book may be used.

The record and charges being made together, thus:

March 2.

JOHN DAY,

To Filling 2)| 2) (3.....$15 00

March 3.

SAM'L. HOWELL,

To Filling Ho| (F.

" " o6o 5) (4| $30 00

In case other filling than gold is used it may be expressed by

a letter, or two letters conveniently placed; thus amalgam fillings may be marked, amal. etc; capped pulps may be marked, oxy., for oxy-chloride of zinc, or any other material used may be expressed in like manner; roots filled, by Rf.; teeth refilled may be designated, or any particulars added that may be thought necessary.

At convenient intervals these records may be gathered from the day book to an indexed book, for ready reference. I am using John Todd's Index Rerum, which I find very convenient for the purpose, and have the records posted at the first of each month, by this means, if I want to refer to anything that has been done for any patient, I have a history of the case at hand. I copy such record from my Index Rerum to show its form:

Miss L. | 1872, June 3, |1)(2; July 2, 1)|(1; July 4, 2)(1|; July 6, 8o| ; 1874, Jan. 3, |2)(3; Jan. 7, |8o amal.; 1876, June 8, Go, Fo| ; June 16, D), oH; 1877, Jan. 15, 5) | oxy(4| ; Jan. 18, D)| Rf.

If it is thought desirable, the positions of fillings may be numbered; such a form of expression is on some accounts desirable, especially in forming tables of statistics, etc. For this purpose, the location of filling may be numbered as follows:

No. 1. The cutting edges of incisors and cuspids; anterior pits of bicuspids and molars.

No. 2. Posterior pits of bicuspids and molars, not used in the incisors and cuspids.

No. 3. Mesial surfaces of any or all teeth.

No. 4. Distal surfaces of any or all teeth.

No. 5. Buccal or labial surfaces.

No. 6. Lingual or palatal surfaces.

These numbers may also be used instead of the curves in ordinary records if thought desirable, by using small figures in connection or with the numbers, or letters representing the teeth, placed in any convenient position.

I append a record of two thousand fillings in tabular form, using this plan. I have not designated the sides of the mouth as this necesitates four tables instead of two. I have also thrown all the grinding surfaces together. The table will be of interest

as showing the comparative numbers of fillings, in different positions.

TOOTH.	POSITIONS.	1 and 2	3	4	5	6	TOTAL.
1.	No. of Fillings.	11	130	111	12	5	269
2.	" "	3	128	68	6	16	221
3.	" "	7	34	49	6	0	96
4.	" "	32	56	88	7	1	184
5.	" "	15	69	67	1	2	154
6.	" "	144	88	24	6	1	263
7.	" "	75	9	12	7	0	103
8.	" "	24	6	1	5	0	36
	Totals	311	520	420	50	25	1326
A.	No. of Fillings	0	3	15	0	0	18
B.	" "	3	15	19	3	0	40
C.	" "	4	8	10	7	0	29
D.	" "	10	14	34	5	0	63
E.	" "	11	30	36	3	0	80
F.	" "	99	49	22	20	0	190
G.	" "	106	22	18	39	2	187
H.	" "	45	7	4	11	0	67
	Total	278	148	158	88	2	674

Total number in upper jaw.....1,326
" " " lower " ..... 674—2,000.

THE ORIGINAL MEANING OF "EMPIRIC."—In ancient times there was a sect of physicians called "Empirics." This was not a contemptuous nick-name bestowed by their adversaries, but a title of honor taken by themselves, and signifying *those who follow experience.* They maintained that in medicine theory is of little avail, and that all future practice, to be successful, must be based upon that which has hitherto been so. The Rationalists, on the other hand, asserted that practice must be deduced from theory, and that diseases can be treated successfully by him alone who understands their causes and their seat.

Journalistic.

The proceedings of the Kings Co. Medical Society, of New York, are published monthly and make a very valuable journal of medical literature. In the February No., is an article written by J. S. Wight, M. D., upon the "Irregularities in the Lengths of Lower Limbs before and after Fractures of the Femur," in which the Dr. claims that the two lower limbs are by no means constantly of the same length in the normal condition. Dr. Wight after fully investigating this subject comes to the following conclusions:

"Only about one person in five have the two lower limbs of the same length."

"The left lower limb is often longer than the right lower limb."

"The difference in length in normal lower limbs varies from one eighth of an inch to one inch."

"Measurements of cadavers and skeletons confirm these results."

"In a few cases the right limb was longer than the left."

These facts have been verified by experiments of Prof. Frank H. Hamilton, of Bellevue Hospital College, and several others of note, and seem to be pretty well established.

How much a fractured femur actually shortens during the reparatory process cannot therefore be accurately determined unless the two limbs have been accurately measured before the fracture took place.

In the *Cosmos*, Dr. Farrar has an article upon Irregularities in which he says: "All mechanical appliances for regulating teeth should, if possible, be constructed upon the principle of the screw or inclined plane." "Forces for the movement of the teeth should be applied once in about twelve hours and as powerfully as possible short of causing pain." We have no doubt but that the screw is one of the most valuable agents at our command in moving teeth, but in many cases it will be much more convenient

to make use of wedges and in some places rubber bands are extremely useful, though we are aware that rubber produces more irritation in the surrounding parts than the screw, which in some cases would be objectionable.

Dr. King, of Pittsburg, writes upon Dental Mallets and condensing instruments. Thinks a packing instrument with wooden handle is more pleasant to patient and more efficient in solidifying a gold plug than any other. He quotes from Prof. Truman's experiments to show that a light steel mallet is most effective. Much careful experimentation will be required to settle these questions. A steel mallet properly constructed and balanced and in a skillful hand will accomplish everything which can be done by any other kind, but much depends upon the malleter. A skillful malleter never allows the mallet to rest heavy upon the packing instrument. The blow should be struck in such a way that the mallet would stop very nearly as soon, if it did not impinge upon the plugging instrument at all. The blow should be such that it will be arrested in its course by the striker just as it taps the instrument, and it never should be wholly arrested by its contact with the impacting instrument.

Dr. Mills grapples with the so-called Riggs Disease. We simply would suggest that if one wishes to throw light upon this disease let them show clearly what it is that he is talking about. It is evident to any one who has watched the writings and discussions upon the so-called Riggs disease for the last year, that there are at least three or four different affections spoken of as coming under this head. It is mostly due to the mixing up of three or four different diseases without any discrimination between them that so much nonsense has been scattered throughout our recent dental literature. If one is writing of tartrous concretions upon the teeth, and its effects, why not say so? If we are to have a treatise upon "spontaneous absorption" of gums and alveolar processes let us know it, and if of ulceration of the margins of the gums from acute gingivitis, for conscience sake, head your article so that we may know what you mean. The ignorance and want of discrimination which has been exhibited upon these subjects in papers and discussions is far from being creditable to us as a profession. Will some one take up some

one of these various maladies and give us a clear description of it to begin with and then it will be time enough to give the treatment. In the hints and queries we find some answers to former questions which are so sharp that if their authors were *young* we should greatly fear that they wouldn't live long; as it is we hope they will still survive in order that they may continue to enlighten those whose early educational advantages have been somewhat neglected.

The *Medical Brief* recommends the following prescription:

℞. Tinc. Cantharides.....℥ ii.
Glycerine.....℥ i.
Rose Water.....℥ ii.

Mr. Osman Vincent, of London, reports having cured eighteen cases of lumbar abscesses without a fatal result. The abscesses were opened and injected with equal parts of water and sulphurous acid and they all healed up. This is a very remarkable result, as these abscesses are proverbally difficult to cure, and we think in many cases they are complicated with careous bones, and in caries of bones, we know of no agent equal in efficacy to dilute sulphuric or sulphurous acids.

Dr. Yandall, of Louisville, Ky., read a paper before the Dermatological Association last year, at Niagara Falls, in which he stoutly maintains that most acute diseases of the skin are due to malarial poisoning, and in order to sustain his position declares that malarial influences are potent in all the northern States, though not so powerful as in the States farther south. He recommends quinine and other principles of peruvian bark in their treatment, and calls attention to the fact that arsenic, which has always held high rank as an antiperiodic, is also an efficient remedy in skin diseases.

The *Boston Journal of Chemistry* says that in 1876–7, 586 surgeons and physicians were licensed, and only nine dentists were licensed in the same time.

A British naval surgeon says that for foreign bodies in the throat blow forcibly into the ear. It seems that strong coffee was an antidote for strychnia.

Proceedings of Dental Societies.

ST. LOUIS DENTAL SOCIETY.

Office of Dr. W. H. Eames,
St. Louis, Feb. 19th. 1878.

TREATMENT OF EXPOSED PULPS.

Dr. Eames :—The subject presented for our consideration this evening, Treatment of Exposed Tooth Pulps, is one of much or little importance, dependent on the view we may entertain of the office of this organ. Whether as we have been taught to believe, we regard it as not only the formative organ of the body of the tooth, but that after this duty has been performed, it helps to maintain the vitality of the tooth, and is constantly until old age, the medium through which nutrition is conveyed to the enamel and dentine; and also, that it is able to protect itself to a certain extent against the encroachments of caries by the development of secondary deposits between it and the enemy; or whether we accept as true the theory recently advocated by some of the learned savons of the profession, viz : that the office of the pulp is solely for the development of the hard tissues of the tooth, its term of office terminating with the complete development of the tooth; that after this period, which may be said to occur at from eighteen to twenty years, after the eruption of the teeth it has no purpose to serve and may therefore be removed without impairing the vitality of the tooth; and in fact in many cases it had better be removed if at all diseased or endangered. To use the words of Dr. Ingersoll, is the pulp essential to the integrity of the tooth structure when matured? and is the treatment of it in all diseased conditions so simple and uniformly successful that deliberate extirpation is an unwarrantable practice ? and furthermore, does the continuance of the teeth in the mouth comfortably and usefully depend largely upon the functional support of a living pulp? To these two questions Dr. Ingersoll and other learned men answer, no! If we accept Dr. Ingersoll's theory as

the correct one, the treatment of exposed or even endangered pulps becomes a very simple matter. They should be removed at once as so much worthless dead matter which if allowed to remain might be the source of trouble. The Dr. has given us some arguments in support of his theory in a paper read before the American Dental association and published in its Transactions, 1877. I have read this paper carefully but failed to see clearly the force of all the Dr.'s arguments. Am not quite convinced as yet that any organ of the body normally developed and conditioned ever becomes a useless mass of tissue, more especially the pulp of a tooth. I still think the pulp worth saving though the wall of its chamber be removed. One of the strongest points given by Dr. Ingersoll in support of his theory, it would seem to to me, proves conclusively that the pulp is capable of protecting itself by a secondary deposit, if not how does this calcification of the dental fibrils of which he speaks take place. What is the source of the lime salts if the pulp plays no part. I am of the opinion that a portion of the odontoblast layer if removed will be renewed and that a seemingly deposit may take place even at this point. I would not go to the extreme of attempting to save a fragment of pulp in a root canal, yet I would not feel that I had done my whole duty did I fail to make the effort to save an exposed pulp, especially if suppuration was not clearly present.

DR. SPALDING.—I do not think that the circulation in the peridental membrane is dependent on that of the pulp. Yet a diseased condition of this membrane is frequently due to a diseased condition of the pulp. This fact is too evident to require elucidation or comment.

As to the reproduction of the odontoblastic layer I am in doubt; but I incline to the opinion that there is no extensive reproduction reproduction of that tissue. When it is once destroyed—when a patch is taken out of it, I very much doubt if the original structure is ever produced. The odontoblasts are a specific class of cells, and I understand the law governing their production to be this; that they are multiplied from without inward, and not laterally to any great extent. Hence if the injury is extensive it is not repaired as it is with ordinary epidemic or other tissue.

During the formative period there is an active proliferation

of these cells. A new inner layer being formed, as an outer one is being calcified. But at maturity this process comes to a halt. At least it proceeds at a greatly diminished pace. It may, however, be excited into abnormal activity, giving rise to the formation of secondary dentine, yet this product is not precisely like primary dentine, and the difference pre-supposes the existence of a corresponding difference in the respective odontoblasts.

I do not agree with the position taken by Dr. Eames, that the reproduction of odontoblasts is the same as other cell growths. Odontoblasts spring from odontoblasts. Either directly, or by metamorphosis of other cells. Physiologically they grow from without inward, and at this time there is no demand for any other method of growth. Are they produced in a lateral direction for the repair of injuries is the debatable point; I incline to the opinion they are not.

Hence I do not consider it good practice to attempt to save the pulp when the odontoblastic layer is much broken, certainly I should not, in such a case, look for the pulp to protect itself by a deposition of secondary dentine.

Dr. Keith.—Can a pulp be uncovered without the removal of this layer?

Dr. Spalding.—Yes, you may even bleed the pulp without removing the layer, but in that case it must be either punctured or incised.

Dr. Keith.—Will creasote destroy it?

Dr. Spalding.—Oh no! a light touch of creasote will only form a thin pellicle of coagulated albumen. A similar thing happens when ordinary cavities are wiped out with creasote, the creasote uniting with the albumen present in the soft parts of the dentine.

Dr. Park.—I cannot conceive of a more convenient theory of practice to follow than that advocated by Dr. Atkinson. I know now no more of the success or failure of pulp capping than I did years ago. I have little faith in the permanent success of the practice in cases of extensive exposure. Have felt that the tooth so treated is not unlike a slumbering volcano. From the fracture of one tooth so treated, an opportunity for examination was afforded me. The pulp was devitalized, but

its form preserved, and it had given no trouble whatever. Feeling more confidence in some other substance for a root filling, removed and filled with gutta percha.

I see no reason why teeth whose roots are perfectly filled may not last indefinitely. To perfectly perform this operation had in most cases been of doubtful accomplishment, until the employment of gutta percha for the purpose was adopted. I cannot see the advantage of preserving a small portion of the nerve at the apex of the roots, except it be for convenience. I want it all removed if any considerable portion.

DR. SPALDING.—Oxy-chloride of zinc will almost surely destroy the vitality of a pulp, if in contact with it. That is, a pulp capped with oxy-chloride will be found to be dead after awhile.

DR. MORRISON :—If a small quantity of disorganized dentine be left over the nerve charged with creasote it will remain perfectly sweet, and I believe it to be the best covering we have for the nerve. I peel off a good layer, leaving a layer over the nerve about 1-16 inch in thickness. I prefer to err by leaving too much than not enough. Filled several teeth some six years since for a nervo-bilious patient; teeth very sensitive; left a large amount of disorganized dentine in the cavities of the bicuspids and molars; some of them good to-day; others I have restored the borders of the cavities and refilled one tooth; the nerve receded and the filling now occupies the space once occupied by the nerve pulp; the tooth is alive and as sensitive as ever. I use collodion or something of that character over the nerve inserting the oxy-chloride. I think a tooth with the root canals well filled, nearly as good as a live tooth.

DR. PARK.—If this theory be correct, why remove decay from any cavity? Why not depend upon a perfect periphery for the preservation of the tooth and avoid inflicting pain by thorough excavation?

DR. SPALDING.—I frequently leave a portion of decalcified dentine over the pulp, and have done so for thirty years. I consider this the very best covering a pulp can possibly have; no artificial cap can compare with it. My success in capping pulps

has not been much, and when the membrana eboris has suffered much injury I usually devitalize.

Dr. Park.—A case came to my knowledge of a lower molar, roots filled with gutta percha which gave such discomfort as to demand extraction. Upon its removal a film of it was found enveloping the apices of the roots. This was removed and the tooth replanted. I have in a great measure abandoned capping, always feeling a degree of doubt concerning the success of the experiment; while with gutta percha as a root filling I feel assured of a satisfactory result.

Dr. Spalding.—Relative to the matter of root fillings I ask why do we fill roots of teeth? Simply to keep out all foreign substances. If the foramen at the apex be hermetically sealed, the essential point is attained. It is immaterial about filling the canal, although I always fill it. Teeth are frequently found with pulps dead, and pulp chambers and roots vacant and sweet; no accumulation of fluids in canal or chamber. This happens for the reason that the foramen has been closed by nature, that is, by a coagulated plug. In filling roots I use gold wound upon a broach but dip the points in the gutta percha solution.

Dr. Park.—How do you destroy a pulp or the remnant of one that is near the end of the root canal?

Dr. Spalding.—By introducing a very minute quantity of the arsenic preparation on the point of a broach.

Dr. Park.—Filled root of an inferior six-year molar with this filling, for a boy aged eight years, renewing the filling in the crown from time to time as demanded, until the patient was twelve years old when I filled it without soreness, although one-eighth ounce of gold was impacted into the filling, showing a most satisfactory condition of the tooth's surroundings and attachments.

Dr. Spalding.—I am an earnest advocate of the practice of saving pulps alive when it can be done, but think we have much yet to learn in that direction. I cannot agree with the opinion that a tooth is as good or as durable after the pulp has been removed as it would be if it were living. The enamel draws its nutrient supply wholly from the dentine. When the pulp is taken away, this source of supply to the dentine is cut off, and this is the chief source.

FRACTURE OF THE LOWER JAW IN AN INFANT.—FRAGMENTS MAINTAINED IN POSITION BY WIRE SUTURE.

BY GEO. A. MURSICK, M. D.

DEAR SIR:—There does not appear on record many reports of cases of Fracture of the Inferior Maxilla, treated by wire sutures. I therefore infer that this method of treatment has not been much practiced. Knowing the great interest you take in the matter of fractures generally, I have thought the history of the following case might be of interest to you.

August 3d, 1876—Williams, a boy aged three years, fell from the third story window of the house in which he lived, to the street, a distance of about thirty feet. I saw him an hour afterwards. He was then insensible, suffering from concussion, etc. Upon examination I found a simple fracture of the inferior maxilla through the middle of the horizontal ramus of the right side. Other than this there was not a scratch or bruise upon him. No dressing was applied until the next day, when he had in a great measure recovered from the shock. There was not much displacement of the bones. To prevent his interfering with the dressings I applied adhesive strips to the jaw in the shape of a Boston bandage. This fixed the jaw firm and immovable. Everything did well until—

August 29th, when he fell down a flight of stairs and refractured his jaw. The end of the *anterior* fragment of the bone was driven through the integument of cheek and overlapped the front of the posterior fragment of the bone about one-half an inch. After some difficulty the ends of the bone were brought in apposition but could not be so retained by any external appliance.

After anesthesia by ether, I dissected the inside of the cheek from the ends of the bone, bored a hole through each end with a brad-awl, passed a stout silver wire suture through, and twisted it tight. This brought the ends of the bone in perfect apposition, and held them securely. The ends of the wire were brought out through the external wound; this served to facilitate free

drainage, as well as the final removal of the suture. After three weeks the fracture was finally united, and two weeks later the suture came away, after which the external wound soon healed. The teeth are level and the articulation perfect. With the exception of some flattening of that side of the face there is no deformity.—*Buffalo Medical and Surgical Journal.*

Incidents in Office Practice.

Mrs. M., from Montana; right central superior incisor had been excised at a point a line and a half from gum; edges left sharp; the nerve canal had been indifferently filled with gold and drilled to receive a gold pivot about two-thirds of a line in diameter; a plate tooth had been nicely fitted to the root, (externally), but being much thinner than the root left fully half of it exposed. Tooth loose; time limited.

Adjusted the dam; found a portion of the filling only a scale *covering merely*, but not anchored to the root; this was removed, proper anchorage (pits) made, supplemented by one *screw*. The surface of the root was covered; a narrow strip of gold plate was soldered (transversely), to the base of the gold pivot, its upper surface accurately filled to the face of the root, the lower surface so formed that being built upon and around served to securely anchor the artificial crown in the desired position. The lingual contour of the natural tooth was in this manner obtained and the tooth restored to usefulness.

CASE 2ND.—Miss T., aged thirteen, May, 1875, had a severe pain in or near the second right superior bicuspid; yielded to topical and constitutional treatment. A year later find an abscess established, which not yielding to local treatment, and fearing absorption of the root, decided to extract and replant. Found the nerve canal quite large, the entire length, and open-

ing on the side a line and a half from the apex; the opening irregular, fully a line and a half in diameter, which explained why treatment through the nerve canal was not successful. On the other side of the root the sac remained. By extraction the radical cure was inaugurated, the tooth was filled and replaced, and is now, January, 1878, in perfect condition.

April, 1874, Miss B., nervo-sanguine temperament, suffering from uterine troubles of severe type, under medical treatment; had also suffered much pain from central incisor to left superior second molar; parts generally inflamed, extending to the roof of the mouth. The left superior lateral incisor was pulpless and thoroughly filled, but decided symptoms from *it* as being the source of trouble were wanting. However, I decided to extract it, upon which as the tooth left the alveolus there followed a stream of pus the full size of the socket. The root was scraped, the socket thoroughly washed and injected with iodine, the tooth rinsed in the same and replaced. A rapid recovery was made. Early in the fall of 1877, a slight discharge from beneath the margin of the gum around this tooth was discovered; also I find under the gum on the anterior face of the root a small cavity, which grows rapidly as time advances (to a few weeks); has penetrated to and exposed the gold root filling for three lines in extent and laterally to half that distance. I am letting it have full sway to see where the end will be. It is my opinion its end will be a microscopical specimen. What kind of a *blast* is at work here? G. A. B.

IOWA STATE DENTAL SOCIETY.

Next meeting at Iowa City, on the first Tuesday after the Fourth of July. The question of locating the Society permanently at Iowa city has been made a special subject for consideration at our next meeting.

Dentists from other States are cordially invited to attend.

I. P. WILSON,

Burlington, Ia. Cor. Sec'y, I. S. D. S.

TWELFTH ANNUAL COMMENCEMENT OF THE MISSOURI DENTAL COLLEGE.

The twelfth annual commencement of the Missouri Dental College took place on Friday, March 8th, 1878, at Mercantile Library Hall, St. Louis, in connection with the St. Louis Medical College.

The following named gentlemen received the degree of Doctor of Dental Surgery: Geo. A. Christman, Chicago; Christian Mathiason, St. Louis; W. B. Simmons, Mississippi; J. S. Scott, Illinois; G. V. Black, Jacksonville, Ills. (Honorary)

Licentiate degree was conferred on Philip Hellmuth, Ills.

Fifty-three gentlemen received the degree of Doctor of Medicine from the St. Louis Medical College,

W. H. Eames, Dean, M. D. C.

Obituary.

DR. PRESCOTT E. WHITE

Died in Brooklyn, N. Y., February 2, 1878, aged, 32 years.

At a regular monthly meeting of the Brooklyn Dental Society, held February 11, 1878, the following resolutions were unanimously adopted.

Whereas, It has pleased Almighty God, in His Divine Wisdom to remove from our midst, in the prime of life and in the height of usefulness, our esteemed professional brother Dr. Prescott E. White; therefore

Resolved, That, although Dr. White has been with us but a comparatively short time, he had endeared himself to us and we had come to regard him as a talented and progressive member of our profession.

Resolved, That we tender to his family our sincere condolence in this hour of their affliction, and that a copy of these resolutions be presented to them, and furnished for publication.

O. E. Hill, President.

C. P. Crandell, Rec. Sec'y., Brooklyn Dental Society.

Microscopy.

A DEPARTMENT OF MICROSCOPY.

We take pleasure in making the announcement to our readers that commencing with our next issue a "Department of Microscopy" will be introduced, presided over by Dr. G. V. Black, of Jacksonville. The Dr. is well known to many of our readers as an ardent student of the microscope, and we feel assured that the details of his observations on the dental tissues, and the abstracts of the science on subjects of special interest to the dentist, which he will collate from other sources, and give to our readers through this department, will add much to the interest and value of the Journal.

Any communications intended for this department should be addressed to G. V. BLACK, D. D. S., Jacksonville, Ills. E.

TO WHOM IT MAY CONCERN.

Dr. Carl Ludwig came to St. Louis and among others I was one of those who bought his instruments and a license to use his process for hardening oxy-cloride fillings, being of the opinion that if one quarter of what he said of his process was true it must be worth having. It was highly recommended for restoring the contour of teeth; and as an instance of how hard it became, he related a case of a Cincinnati dentist who had restored a central incisor, but the next day finding it too long, endeavored to cut it off but could find nothing that would touch it; the patient was taken to the office of another dentist who had a *diamond disk* and with *this managed to cut off a little.*

I had a first inferior bicuspid to build up from the gum and thought this an excellent opportunity to test the new "patent

process." The crown was finished in about two hours; for I was told by the Doctor that the more time and care expended the more dense would be the filling; but unfortunately the crown came off before my patient left the office. Thinking that my manipulations *might* be in some respect faulty, I sent for Dr. Ludwig to come to my office and with *his own material, instruments, etc.*, to perform the operation *himself*. He did so and departed assuring the patient and me that the crown would last I forget how many years. It lasted just *three days*, the patient having used the greatest care to guard against accident. What others have done with it I know not, but I confess—

I. M. Sold.

STOP THIEF!

A man giving the name of Carroll came to me for work in my laboratory. I employed him and gave him a gold case to repair. He started for the dental depot to select the teeth and that is the last seen of him or the plate. I find he has gone by the name of Morrison and Allen. He is about five feet six inches in height, weighs about 130, dark complexion, dark hair and eyes, black moustache and goatee. Has a quick, restless movement and walk; says he has worked in Pottsville, Pa., for Dr. Liders. While passing through St. Louis he represented himself as coming from the Black Hills. He is also a book binder. Hard drinker.

H. H. K.

Building a Pyramid on the Point.—Dr. B. B. Allen, of Sonoma county, Cal., writing to the *Richmond and Louisville Medical Journal*, settles the question in regard to the use of salicylic acid in rheumatism after this fashion: "I gave it a fair trial a short time ago, and caused my patient to be very delirious, and he derived no benefit from the remedy; but if he had continued to take it a few days longer, the undertaker would have had a job." Whereupon we feel inclined to remark, that the strong propensity natural to the human mind to draw hasty conclusions, to deduce broad principles from narrow data, to evoke general rules from a few facts, has balked the progress of medical science and vitiated the practice of medical men more than all other causes combined.

Scraps, Notes and Queries.

CONVENIENT PLASTER CUPS.—Two very convenient cups for plaster work can be made by cutting a hollow india-rubber ball four or five in inches in diameter in halves. These cups possess the advantage of being easily cleaned. If plaster has been left to harden in them turn your cup wrong side out and it is clean an item to be appreciated by those who do much laboratory work. If Mr. White or some other dental manufacturer would take the hint and put some rubber cups adapted to this purpose in the market they would meet with ready sale. WILL. E.

GLYCERINE FOR PREVENTING ADHESION TO INSTRUMENTS.—Those who use gutta percha for filling root canals, may have been annoyed by its adherance to the surrounding walls of the tooth and cavity. A dressing of glycerine (just a trace) will prevent this. A little on the instruments used is equally beneficial. Glycerine on glass ground stoppers to bottles prevent the escape of the contents and renders easy their removal.

G. A. B.

DEAR SIR :—Please enquire for me through your valuable Journal the address of a reliable CARVER of teeth. I have been put to much trouble to get teeth for several special cases, and have not succeeded to my satisfaction.

Also, for a successful metnod of treating and filling bicuspids and molars after the death of the pulp; materials included.

M-a.

CATGUT FOR ROOT FILLING.—The great advantage claimed by Lister for carbolized catgut in deep sutures is that it is absorbed in a few days by the wound secretions, the carbolic acid enabling it to resist only long enough to allow the parts to heal. Is this property of solubility desirable in root filling material supposing it possible to manipulate it with as much ease as gutta percha?

KEITH.

SOLIDIFICATION OF HYDROGEN.—At the *Academie des Sciences* on the 14th January, M. Dumas announced that M. Roaul Pictet had effected the solidification of hydrogen at Geneva on the 10th of January. This remarkable success was obtained under a pressure of 650 atmospreres and at a temperature of —370°

THIRD DENTITION.—An octogenarian of Sanford Street, Brooklyn, is said to have passed through a triple dentition—inclusive of wisdom teeth.

Diplomas.—Germany is still waging war against the illegal use of the doctor's title. A "Dr." Harmuth in Berlin who received his diploma from Philadelphia, was lately sentenced to pay 300 marks for using the prefix publicly.

Common Names versus Latin Names.—From secular sources frequently, from professional sources occasionally, comes an outcry against the use of Latin instead of common names for medicinal substances. Such complainants do not reflect that the Latin name is the *proper* name, whilst common names are applied arbitrarily and confusedly, the same plant, for instance, often has several common names, and the same being often applied to several plants. Thus we notice in an Eastern journal an account of the medical properties of the "Agrimonia eupatoria, or cockle-burr." There can be no mistake in regard to the former or Latin name. Everywhere in America, Europe, and elsewhere, it would be known as applicable to the same plant. But in the middle Atlantic States the "cockle-burr" is a plant altogether different—a species of Xanthium. In other sections of our country still another plant may bear that name; whilst in foreign countries the name may never have been heard of.

Uses of the Lemon. The London *Lancet* says: "Few people know the value of lemon-juice. A piece of lemon bound upon a corn will cure it in a few days; it should be renewed night and morning. A free use of lemon-juice and sugar will always relieve a cough. Most people feel poorly in the spring, but if they would eat a lemon before breaksast every day for a week—with or without sugar, as they like—they would find it better than any medicine. Lemon-juice, used according to this recipe, will sometimes cure consumption: Put a dozen lemons into cold water and slowly bring to a boil; boil slowly until the lemons are soft, then squeeze until all the juice is extraced; add sugar to your taste and drink. In this way use one dozen a day. If they cause pain, lessen the quantity and use only five or six a day until you are better, and then begin again with a dozen a day. After using five or six dozen the patient will begin to gain flesh and enjoy food. Hold on to the lemons, and still use them very freely for several weeks more. Another use for lemons is for a refreshing drink in summer, or in sickness at any time. Prepare as directed above and add water and sugar. But in order to have this keep well, after boiling the lemons squeeze and strain carefully; then to every half pint of juice add one pound of loaf or crushed sugar, boil and stir until the sugar is dissolved, skim carefully and bottle. You will get more juice from the lemons by boling them, and the preparation keeps better."

Books and Pamphlets Received.

REFERENCE AND DOSE BOOK. By C. Henri Leonard M. A., M. D. Third edition, revised and enlarged. Gray, Baker & Co., St. Louis, Mo.

NEW YORK EAR DISPENSARY. Seventh Annual Report of the Board of Trustees, 1878.

MICHIGAN DENTAL ASSOCIATION. Transactions of the Twenty-Second Annual Session, held at Ann Arbor, October, 1877. Ransom & Randolph, Toledo, Ohio, Publishers.

THE DENTAL AND ORAL SCIENCE MAGAZINE. Devoted to professional interests and the Transactions of the New York Odontological Society. James E. Dexter, Editor, R. S. Williams, New York, Publisher. A New Quarterly; terms $2.00.

MALARIA AND STRUMA IN THEIR RELATION TO THE ETIOLOGY OF SKIN DISEASES. By L. P. Yandell, Jr., M. D., Louisville, Ky. Reprint from *American Practitioner*, January, 1878.

TWENTY-FIFTH ANNUAL ANNOUNCEMENT MEDICAL DEPARTMENT UNIVERSITY OF VERMONT, for the Year 1878.

MONTHLY JOURNAL OF THE SOUTHERN ILLINOIS MEDICAL ASSOCIATION. C. W. Dunning, Editor, Cairo, Ill.

CIRCULARS OF INFORMATION OF THE BUREAU OF EDUCATION. Reports on the System of Public Instruction in China. Contributions to the History of Medical Education and Medical Institutes in the United States of America, from 1776 to 1876. Special Report prepared for the United States Bureau of Education, by N. S. Davis, A. M., M. D.

ANNUAL ANNOUNCEMENT OF THE MEDICAL COLLEGE OF THE PACIFIC, being the Medical Department of University (City) College, San Francisco. Session of 1878.

ANNUAL ANNOUNCEMENT OF THE MEDICAL DEPARTMENT OF THE IOWA STATE UNIVERSITY, at Iowa City.

PROCEEDINGS OF THE MEDICAL SOCIETY of the County of Kings, Brooklyn, N. Y.

FEMORO POPLITEAL, NEURALGIA NEURALGIA ISCHIADICA SCIATICA. By J. Martine Kershaw, M. D., St. Louis, Mo.

THE MISSOURI

DENTAL JOURNAL,

A MONTHLY RECORD OF MEDICAL SCIENCE.

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SPONTANEOUS GENERATION.

BY PROF. JOHN TYNDALL, F. R. S.

II.

Let us now return to London and fix our attention on the dust of *its* air. Suppose a room in which the house-maid has finished her work to be completely closed, with the exception of an aperture in a shutter through which a sunbeam enters and crosses the room. The floating dust reveals the track of the light. Let a lens be placed in the aperture to condense the beam. Its parallel rays are now converged to a cone, at the apex of which the dust is raised to almost unbroken whiteness by the intensity of its illumination. Defended from all glare, the eye is peculiarly sensitive to this scattered light. The floating dust of London rooms is organic, and may be burned without leaving visible residue. The action of a spirit-lamp flame upon the floating matter has been elsewhere thus described:

"In a cylindrical beam which strongly illuminated the dust of our laboratory, I placed an ignited spirit-lamp. Mingling with the flame, and round its rim, were seen curious wreaths of darkness resembling an intensely black smoke. On placing the flame at some distance below the beam, the same dark masses stormed upward. They were blacker than the blackest smoke ever seen issuing from the funnel of a steamer; and

their resemblance to smoke was so perfect as to prompt the conlusion that the apparently pure flame of the alcohol-lamp required but a beam of sufficient intensity to reveal its clouds of liberated carbon.

"But is the blackness smoke? This question presented itself in a moment, and was thus answered: A red-hot poker was placed underneath the beam; from it the black wreaths also ascended. A large hydrogen-flame, which emits no smoke, was next employed, and it also produced with augmented copiousness those whirling masses of darkness. Smoke being out of the question, what is the darkness? It is simply that of stellar space; that is to say, blackness resulting from the absence from the track of the beam of all matter competent to scatter its light. When the flame was placed below the beam, the floating matter was destroyed *in situ*; and the heated air, freed from this matter, rose into the beam, jostled aside the illuminated particles, and substituted for their light the darkness due to its own perfect transparency. Nothing could more forcibly illustrate the invisibility of the agent which renders all things visible. The beam crossed, unseen, the black chasm formed by the transparent air, while, at both sides of the gap, the thick-strewed particles shone out like a luminous solid under the powerful illumination." [1]

Supposing an infusion intrinsically barren, but readily susceptible of putrefaction when exposed to common air, to be brought into contact with this unilluminable air, what would be the result? It would never putrefy. It might, however, be urged that the air is spoiled by its violent calcination. Oxygen passed through a spirit-lamp flame is, it may be thought, no longer the oxygen suitable for the development and maintenance of life. We have an easy escape from this difficulty, which is based, however, upon the unproved assumption that the air has been affected by the flame. Let a condensed beam be sent through a large flask or bolt-head containing common air. The track of the beam is seen within the flask—the dust revealing the light, and the light revealing the dust. Cork the flask, stuff its neck with cotton-wool, or simply turn it mouth downward and leave it undisturbed for a day or two. Examined afterward with the luminous beam, no track is visible; the light passes through the flask as through a vacuum. The floating matter has abolished itself, being now attached to the interior surface of the flask. Were it our object, as it will be subsequently, to effectually detain the dirt, we might coat that surface with some sticky substance. Here, then, without "torturing" the air in any way,

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[1] "Fragments of Science," fifth edition, pp. 128, 129.

we have found a means of ridding it, or rather of enabling it to rid itself, of floating matter.

We have now to devise a means of testing the action of such spontaneously purified air upon putrescible infusions. Wooden chambers, or cases, are accordingly constructed having glass fronts, side windows, and back doors. Through the bottoms of the chambers test-tubes pass air-tight, their open ends, for about one-fifth of the length of the tubes, being within the chambers. Provision is made for a free connection through sinuous channels between the inner and the outer air. Through such channels, though open, no dust will reach the chamber. The top of each chamber is perforated by a circular hole two inches in diameter and closed air-tight by a sheet of India-rubber. This is pierced in the middle by a pin, and through the pin-hole is pushed the shank of a long pipette, ending above in a small funnel. The shank also passes through a stuffing-box of cotton-wool moistened with glycerine; so that, tightly clasped by the rubber and wool, the pipette is not likely in its motions up and down to carry any dust into the chamber.

The chamber is carefully closed and permitted to remain quiet for two or three days. Examined at the beginning by a beam sent through its windows, the air is found laden with floating matter, which in three days has wholly disappeared. To prevent its ever rising again into the chambers, the internal surface is coated with glycerine. The fresh but putrescible liquid is introduced into the six tubes in succession by means of the pipette. Permitted to remain without further precaution, every one of the tubes would putrefy and fill itself with life. The liquid has been in contact with dust-laden air by which it has been infected, and the infection must be destroyed. This is done by plunging the six tubes into a bath of heated oil and boiling the infusion. The time requisite to destroy the infection depends wholly upon its nature. Two minutes' boiling suffices to destroy some contagia, whereas two hundred minutes' boiling fails to destroy others. After the infusion has been sterilized, the oil-bath is withdrawn, and the liquid, whose putrescibility has been in no way affected by the boiling, is abandoned to the air of the chamber.

With such chambers I tested in the autumn and winter of 1875

–'76, infusions of the most various kinds, embracing natural animal liquids, the flesh and viscera of domestic animals, game, fish, and vegetables. More than fifty moteless chambers, each with its series of infusions, were then tested, many of them repeatedly. There was no shade of uncertainty in any of the results. In every instance we had, within the chamber, perfect limpidity and sweetness, which in some cases lasted for more than a year—without the chamber, with the same infusion, putridity, and its characteristic smells. In no instance was the least countenance lent to the notion that an infusion deprived by heat of its inherent life, and placed in contact with air cleansed of its visibly suspended matter, has any power whatever to generate life anew.

Remembering then, the number and variety of the infusions employed, and the strictness of our adherence to the rules of preparation laid down by the heterogenists themselves; remembering that we have operated upon the very substances recommended by them as capable of furnishing even in untrained hands easy and decisive proofs of spontaneous generation and that we have added to their substances many others of our own —if this pretended generative power were a reality, surely it must have manifested itself somewhere. Speaking roundly, I should say that at least 500 chances have been given to it, but it has nowhere appeared. The argument is now to be closed and clinched by an experiment which will remove every residue of doubt as to the ability of the infusions to sustain life. We open the back-doors of our sealed chambers, and permit the common air with its floating particles to have access to our tubes. For three months they have remained pellucid and sweet—flesh, fish, and vegetable extracts, purer than ever cook manufactured. Three days' exposure to the dusty air suffices to render them muddy, fetid, and swarming with infusorial life. The liquids are thus proved, one and all, ready for putrefaction when the contaminating agent is applied. I invite my colleague to reflect on these facts. How will he account for the absolute immunity of a liquid exposed for months in a warm room to optically pure air, and its infallible putrefaction in a few days when exposed to dust-laden air? He must, I submit, bow the conclusion that the dust-particles are the cause of putrefactive life. And, unless

he accepts the hypothesis that these particles, being dead in the air, are, in the liquid, miraculously kindled into living things, he must conclude that the life we have observed springs from germs or organisms diffused through the atmosphere.

The experiments with hermetically-sealed flasks have reached the number of 940. A sample group of 130 of them were laid before the Royal Society on January 13, 1876. They were utterly free from life, having been completely sterilized by three minutes' boiling. I took special care that the temperatures to which the flasks were exposed should include those previously alleged to be efficient. I copied, indeed, accurately the conditions laid down by our most conspicuous heterogenist, but I failed to corroborate him. He then laid stress on the question of warmth, suddenly adding 30° to the temperatures with which both he and I had previously worked. Waiving all argument or protest against the caprice thus manifested, I met this new requirement also. The sealed tubes, which had proved barren in the Royal Institution, were suspended in perforated boxes, and placed under the supervision of an intelligent assistant in the Turkish Bath in Jermyn Street. From two to six days had been allowed for the generation of organisms in hermetically-sealed tubes. Mine remained in the washing-room of the bath for nine days. Thermometers placed in the boxes, and read off twice or three times a day, showed the temperature to vary from a minimum of 101° to a maximum of 112° Fahr. At the end of nine days the infusions were as clear as at the beginning. They were then removed to a warmer position. A temperature of 115° had been mentioned as particularly favorable to spontaneous generation. For fourteen days the temperature of the Turkish bath hovered about this point, falling once as low as 106°, reaching 116° on three occasions, 118° on one, and 119° on two. The result was quite the same as that just recorded. The higher temperatures proved perfectly incompetent to develop life.

Taking the actual experiment we have made as a basis of calculation, if our 940 flasks were opened on the hay-loft of the Bel Alp 858 of them would become filled with organisms The escape of the remaining 82 strengthens our case against the heterogenists, proving as it does conclusively that not in the air, nor in the infusions, nor in anything continuous diffused through

the air, but in *discrete particles* nourished by the infusions, we are to seek the cause of life. Our experiment proves these particles to be in some cases so far apart on the hay-loft as to permit 10 per cent. of our flasks to take in air without contracting contamination. A quarter of a century ago Pasteur proved the cause of "so-called spontaneous generation" to be *discontinuous.* I have already referred to his observation that 12 out of 20 flasks opened on the plains escaped infection, while 19 out of 20 flasks opened on the Mer de Glace escaped. Our own experiment at the Bel Alp is a more emphatic instance of the same kind, 90 per cent. of the flasks opened in the hay-loft being smitten, while not one of those opened on the free mountain ledge was attacked. The power of the air as regards putrefactive infection is incessantly changing through natural causes, and we are able to alter it at will. Of a number of flasks opened in 1876 in the laboratory of the Royal Institution, 42 per cent were smitten, while 58 per cent. escaped. In 1877 the proportion in the same laboratory was 68 per cent. smitten to 32 intact. The greater mortality, so to speak, of the infusions in 1877 was due to the presence of hay which diffused its germinal dust in the laboratory air, causing it to approximate, as regards infective virulence, to the air of the Alpine loft. I would ask my friend to bring his scientific penetration to bear upon all the foregoing facts. They do not prove spontaneous generation to be "impossible." My assertions, however, relate not to "possibilities," but to *proofs*, and the experiments just described do most distinctly prove the evidence on which the heterogenist relies to be written on waste paper.

My friend will not, I am persuaded, dispute these results; but he may be disposed to urge that other able and honorable men working at the same subject have arrived at conclusions different from mine. Most freely granted, but let me here recur to the remarks already made in speaking of the experiments of Spallanzani, to the effect that the failure of others to confirm his results by no means upsets their evidence. To fix the ideas, let us suppose that my colleague comes to the laboratory of the Royal Institution, repeats there my experiments, and obtains confirmatory results; and that he then goes to Univerity or King's College, where, operating with the same infusions, he

obtains contradictory results. Will he be disposed to conclude that the self-same substance is barren in Albemarle Street and fruitful in Gower Street or the Strand. His Alpine experience has already made known to him the literally infinite differences existing between different samples of air as regards their capacity for putrefactive infection. And, possessing this knowledge, will he not substitute, for the adventurous conclusion that an organic infusion is barren at one place and spontaneously generative at another, the more rational and obvious one that the air of the two localities which has had access to the infusion is infective in different degrees?

As regards workmanship, moreover, he will not fail to bear in mind that *fruitfulness* may be due to errors of manipulation, while *barrenness* involves the presumption of correct experiment. It is only the careful worker that can secure the latter, while it is open to every novice to obtain the former. Barrenness is the result at which the conscientious experimenter, whatever his theoretic convictions may be, ought to aim, omitting no pains to secure it, and resorting, only when there is no escape from it, to the conclusion that the life observed comes from no source which correct experiment could neutralize or avoid. Let us again take a definite case. Supposing my colleague to operate with the same apparent care on 100 infusions—or rather on 100 samples of the same infusion—and that 50 of them prove fruitful and 50 barren. Are we to say that the evidence for and against heterogeny is equally balanced? There are some who would not only say this, but who would treasure up the 50 fruitful flasks, as "positive" results, and lower the evidential value of the 50 barren flasks by labeling them "negative" results. This as shown by Dr. William Roberts, is an exact inversion of the true order of terms positive and negative.[1] Not such, I trust, would be the course pursued by my friend. As regards the 50 fruitful flasks he would, I doubt not, repeat the experiment with redoubled care and scrutiny, and, not by one repetition only, but by many, assure himself that he had not fallen into error. Such faithful scrutiny fully carried out would infallibly lead him to

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[1] *See* his truly philosphical remarks on this head in the *British Medical Journal*, 1876, p. 282.

the conclusion that here, as in all other cases, the evidence in favor of spontaneous generation crumbles in the grasp of the competent inquirer.

The botanist knows that different seeds possess different powers of resistance to heat.[1] Some are killed by a momentary exposure to the boiling temperature, while others withstand it for several hours. Most of our ordinary seeds are rapidly killed, while Pouchet made known to the Paris Academy of Sciences, in 1866, that certain seeds, which had been transported in fleeces of wool from Brazil, germinated after four hours' boiling. The germs of the air vary as much among themselves as the seeds of the botanist. In some localities the diffused germs are so tender that boiling for five minutes, or even less, would be sure to destroy them all; in other localities the diffused germs are so obstinate that many hours' boiling would be requisite to deprive them of their power of germination. The absence or presence of a truss of desiccated hay would produce differences as great as those here described. The greatest endurance that I have ever observed—and I believe it is the greatest on record—was a case of survival after eight hours' boiling. As regards their power of resisting heat, the infusorial germs of our atmosphere might be classified under the following and intermediate heads: Killed in five minutes; not killed in five minutes but killed in fifteen; not killed in fifteen minutes but killed in thirty; not killed in thirty minutes but killed in an hour; not killed in an hour but in two hours; not killed in two but killed in three hours; not killed in three but killed in four hours. I have had several cases of survival after four and five hours' boiling, some survivals after six, and one after eight hours' boiling. Thus far has experiment actually reached, but there is no valid warrant for fixing upon even eight hours as the extreme limit of vital resistance. Probably more extended researches (though mine have been very extensive) would reveal germs more obstinate still. It is also certain that we might begin earlier, and finds germs which are destroyed by a temperature far below that of boiling water. In

[1] I am indebted to Dr. Thistleton Dyer for various illustrations of such differences. It is, however, surprising that a subject of such high scientific importance should not have been more thoroughly explored. Here the scoundrels who deal in killed seeds might be able to add to our knowledge.

the presence of such facts, to speak of *a* death-point of bacteria and their germs would be mere nonsense—but of this more anon.

We have now to test one of the principal foundations of the doctrine of spontaneous generation as formulated in this country. With this view, I place before my friend and co-enquirer two liquids which have been kept for six months in one of our sealed chambers, exposed to optically pure air. The one is a mineral solution containing in proper proportions all the substances which enter into the composition of bacteria, the other is an infusion of turnip—it might be any one of a hundred other infusions, animal or vegetable. Both liquids are as clear as distilled water, and there is no trace of life in either of them. They are, in fact, completely sterilized. A mutton-chop, over which a little water has been poured to keep its juices from drying up, has lain for three days upon a plate in our warm room. It smells offensively. Placing a drop of the fetid mutton-juice under a microscope, it is found swarming with the bacteria which live by putrefaction, and without which no putrefaction can occur. With a speck of the swarming liquid I inoculate the clear mineral solution and the clear turnip infusion, as a surgeon might inoculate an infant with vaccine lymph. In four-and-twenty hours the transparent liquids have become turbid throughout, and, instead of being barren as at first, they are teeming with life. The experiment may be repeated a thousand times with the same invariable result. To the naked eye the liquids at the beginning were alike, being both equally transparent—to the naked eye they are alike at the end, being equally muddy. Instead of putrid mutton-juice we might take as a source of infection any one of a hundred other putrid liquids, animal or vegetable. So long as the liquid contains the living bacteria, a speck of it communicated to the clear mineral solution, or to the clear turnip-infusion, produces in twenty-four hours the effect that we have described.

We now vary the experiment thus: Opening the back-door of another closed chamber which has contained for months the pure mineral solution and the pure turnip-infusion side by side, I drop into each of them a small pinch of laboratory dust. The effect here is tardier than when the speck of putrid liquid was employed. In three days, however, after its infection with the

dust, the turnip infusion is muddy, and swarming as before with bacteria. But what about the mineral solution which, in our first experiment, behaved in a manner undistinguishable from the turnip-juice? At the end of three days there is not a bacterium to be found in it. At the end of three weeks it is equally innocent of bacterial life. We may repeat the experiment with the solution and the infusion a hundred times, with the same invariable result. Always in the case of the latter the sowing of the atmospheric dust yields a crop of bacteria—never in the former does the dry germinal matter kindle into active life.[1] What is the inference which the reflecting mind must draw from this experiment? Is it not as clear as day that while both liquids are able to feed the bacteria and to enable them to increase and multiply, *after they have been once fully developed*, only one of the liquids is able to develop into active bacteria the germinal dust of the air?

I invite my friend to reflect upon this conclusion; he will, I think, see that there is no escape from it. He may, if he prefers it, hold the opinion, which I consider erroneous, that bacteria exists in the air, not as germs but as desiccated organisms. The inference remains that, while the one liquid is able to force the passage from the inactive to the active state, the other is not.

But this is not at all the inference which has been drawn from experiments with the mineral solution. Seeing its ability to nourish bacteria when once inoculated with the living active organism, and observing that no bacteria appeared in the solution after long exposure to the air, the inference was drawn that *neither bacteria nor their germs existed in the air*. Throughout Germany the ablest literature of the subject, even that opposed to heterogeny, is infected with this error; while heterogenists at home and abroad have based upon it a triumphant demonstration of their doctrine. It is proved, they say, by the deportment of the mineral solution that neither bacteria nor their germs exist in the air; hence, if, on exposing a thoroughly ster-

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[1] This is the deportment of the mineral solution as described by others. My own experiments would lead me say that the development of the bacteria, though exceedingly slow and difficult, is not impossible.

ilized turnip infusion to the air, bacteria appear, they must of necessity have been spontaneously generated. In the words of Dr. Bastian, uttered not in a popular book, but in the "Proceedings of the Royal Society,"[1] with reference to this very experiment: "We can only infer that while the boiled saline solution is quite incapable of engendering bacteria, such organisms are able to rise *de novo* in the boiled organic infusion." I would ask my eminent colleague what he thinks of this reasoning now? The *datum* is, "A mineral solution exposed to common air does not develop bacteria;" the *inference* is, "Therefore, if a turnip infusion similarly exposed develop bacteria, they must be spontaneously generated." The inference, on the face of it, is an unwarranted one. But, while as matter of logic it is inconclusive, as matter of fact it is chimerical. London air is as surely charged with the germs of bacteria as London chimneys are with smoke. The inference just referred to is completely disposed of by the simple question: "Why, when your sterilized organic infusion is exposed to optically pure air, should this generation of life *de novo* utterly cease? Why should I be able to preserve my turnip juice side by side with your saline solution for the three hundred and sixty-five days of the year, in free connection with the general atmosphere, on the sole condition that the portion of that atmosphere in contact with the juice shall be visibly free from floating dust, while three days' exposure to that dust fills it with bacteria?" Am I over sanguine in hoping that, as regards the argument here set forth, he who runs may read, and he who reads may understand? Let me add, however, that while exposing the fallacy of the inferences drawn from it, I regard the observation that the boiled saline solution can sustain the developed organisms, while it cannot develop them from the dry germinal matter of the air, as an important addition to our knowledge. We are indebted for it to Dr. Burdon-Sanderson, who soon saw that his first interpretation of it went too far, and who, in a communication recently presented to the Royal Society, abandons the interpretation altogether.

We now proceed to the calm and thorough consideration of

1. Vol. xxi. p. 130.

another subject, more important if possible than the foregoing one, but like it somewhat difficult to seize by reason of the very opulence of the phraseology, logical and rhetorical, in which it has been set forth. The subject now to be considered relates to what has been called "the death-point of bacteria." Those who happen to be acquainted with the modern English literature of the question will remember how challenge after challenge has been issued to panspermatists in general, and to one or two home workers in particular, to come to close quarters on this cardinal point. It is obviously the stronghold of the English heterogenist. "Water," he says, "is boiling merrily over a fire, when some luckless person upsets the vessel so that the heated fluid exercises its scathing influence upon an uncovered portion of the body—hand, arm, or face. Here at all events there is no room for doubt. Boiling water unquestionably exercises a most pernicious and rapidly destructive effect upon the living matter of which we are composed."[1] And, lest it should be supposed that it is the high organization which, in this case, renders the body susceptible to heat, he refers to the action of boiling water on the hen's egg to dissipate the notion. "The conclusion," he says, "would seem to force itself upon us that there is something intrinsically deleterious in the action of boiling water upon living matter—whether this matter be of high or of low organization."[2] Again, at another place, "It has been shown that the briefest exposure to the influence of boiling water is destructive of all living matter."[3] Throughout his prolonged disquisitions on this subject, Dr. Bastian makes special kinds of living matter do duty for *all* kinds. To invalidate the foregoing statements it is only necessary to say that eight years before they were made it had been known to the wool-staplers of Elbœuf, and Pouchet had published the fact in the *Comptes-Rendus of the Paris Academy of Sciences*,[4] that the desiccated seeds of the Brazilian plant *mendicago* survived fully four hours' boiling. Pouchet himself boiled the seeds, and found some of them swollen and disintegrated,

1. Bastian, "Evolution," p. 133.
2. Ibid., p. 135.
3. Ibid., p. 46.
4. Vol. lxiii, p. 939.

while others remained hard and unswollen. Sown in the same earth, the latter germinated while the former did not. So much for the heterogenist's mistake regarding ordinary seeds; we must now examine whether no error underlies his experiments and his reasonings as to "the death-point of bacteria."

The experiments already recorded plainly show that there is a marked difference between the dry bacterial matter of the air, and the wet, soft, and active bacteria of putrefying organic liquids. The one can be luxuriantly bred in the saline solution, the others refuse to be born there, while both of them are copiously developed in a sterilized turnip infusion. Inferences, as we have already seen, founded on the deportment of the one liquid cannot with the warrant of scientific logic be extended to the other. But this is exactly what the heterogenist has done, thus repeating, as regards the death-point of bacteria, the error into which he fell concerning the germs of the air. Let us boil our muddy mineral solution with its swarming bacteria for five minutes. In the soft, succulent condition in which they exist in the solution not one of them escapes destruction. The same is true of the turnip infusion if it be inoculated with the living bacteria only—the aerial dust being carefully excluded. In both cases the dead organisms sink to the bottom of the liquid, and without reinoculatiion no fresh organisms will arise. But the case is entirely different when we inoculate our turnip infusion with the desiccated germinal matter afloat in the air.

The "death-point" of bacteria is the maximum temperature at which they can live, or the minimum temperature at which they cease to live. If, for example, they survive a temperature of 140°, and do not survive a temperature of 150°, the death-point lies somewhere between these two temperatures. Vaccine lymph, for example, is proved by Messrs. Braidwood and Vacher to be deprived of its power of infection by brief exposure to a temperature between 140° and 150° Fahr. This may be regarded as the death-point of the lymph, or rather of the particles diffused in the lymph, which constitute the real contagium. If no time, however, be named for the application of the heat, the term "death-point," is a vague one. An infusion, for example, which will resist five hours' continuous exposure to the boiling temperature, will succumb to five days' exposure to a tem-

perature 50° below that of boiling. The fully developed, soft bacteria of putrefying liquids are not only killed by five minutes' boiling, but by less than a single minutes' boiling—indeed, they are slain at about the same temperature as the vaccine. The same is true of the plastic, active bacteria of the turnip infusion.[1] But, instead of choosing a putrefying liquid for inoculation, let us prepare and employ our inoculating substance in the following simple way: Let a small wisp of hay, desiccated by age, be washed in a glass of water, and let a perfectly sterilized turnip infusion be inoculated with the washing fluid. After three hours' continuous boiling the infusion thus infected will often develop luxuriant bacterial life. Precisely the same occurs if a turnip infusion be prepared in an atmosphere well charged with desiccated hay-germs. The infusion in this case infects itself without special inoculation, and its subsequent resistance to sterilization is often very great. On the 1st of March last I purposely infected the air of our laboratory with the germinal dust of a sapless kind of hay mown in 1875. Ten groups of flasks were charged with turnip infusion prepared in the infected laboratory, and were afterward subjected to the boiling temperature for periods varying from 15 minutes to 240 minutes. Out of the ten groups only one was sterilized—that, namely, which had been boiled for four hours. Every flask of the nine groups which had been boiled for 15, 30, 45, 60, 75, 90, 105, 120, and 180 minutes respectively, bred organisms afterward. The same is true of other vegetable infusions. On the 28th of February last, for example, I boiled six flasks, containing cucumber infusion, prepared in an infected atmosphere, for periods of 15, 30, 45, 60, 120, and 180 minutes. Every flask of the group subsequently developed organisms. On the same day, in the case of three flasks, the boiling was prolonged to 240, 300, and 360 minutes; and these three flasks were completely sterilized. Animal infusions, which under ordinary circumstances are rendered in-

1. In my paper in the "Philosophical Transactions" for 1876, I pointed out and illustrated experimentally the difference, as regards rapidity of development between water-germs and air-germs; the growth from the already softened water-germs proving to be practically as rapid as from developed bacteria. This preparedness of the germ for rapid development is associated with its preparedness for rapid destruction.

fallibly barren by five minutes' boiling, behave like the vegetable infusions in an infective atmosphere. On the 30th of March, for example, five flasks were charged with a clear infusion of beef and boiled for 60 minutes, 120 minutes, 180 minutes, 240 and 300 minutes reespectively. Every one of them became subsequently crowded with organisms, and the same happened to a perfectly pellucid mutton infusion prepared at the same time. The cases are to be numbered by hundreds in which similar powers of resistance were manifested by infusions of the most diverse kinds.

In the presence of such facts I would ask my eminent colleague whether it is necessary to dwell for a single instant on the one-sidedness of the evidence which led to the conclusion that all living matter has its life destroyed by the "briefest exposure to the influence of boiling water." An infusion proved to be barren by six months' exposure to moteless air kept at a temperature of 90° Fahr., when inoculated with full-grown, active bacteria, fills itself in two days with organisms so sensitive as to be killed by a few minute's exposure to a temperature much below that of boiling water. But the extension of this result to the desiccated germinal matter of the air is without warrant or justification. This is obvious without going beyond the argument itself. But we have gone far beyond the argument and proved by multiplied experiment the alleged destruction of all living matter by the briefest exposure to the influence of boiling water to be a delusion. The whole logical edifice raised upon this basis falls, therefore, to the ground; and the argument that bacteria and their germs being destroyed at 140° must, if they appear after exposure to 212°, be spontaneously generated, is, I trust, silenced forever.

Through the precautions, variations, and repetitions observed and executed with the view of rendering its results secure, the separate vessels employed in this inquiry have amounted up in two years to nearly 10,000. Here, however, and with reason, the editor cries, "Halt!" I had hoped, when I began, to carry the argument farther. Besides the philosophic interest attaching the problem of life's origin, which will be always immense, there are the practical interests involved in the application of the doctrines here discussed to surgery and medicine. The antisep-

tic system, at which I have already glanced, illustrates the manner in which beneficent results of the gravest moment follow in the wake of clear theoretic insight. Surgery was once a noble art; it is now, as well, a noble science. Prior to the introduction of the antiseptic system, the thoughtful surgeon could not have failed to learn empirically that there is something in the air which often defeated the most consummate operative skill. That something the antiseptic treatment destroys or renders innocuous. At King's College Mr. Lister operates and dresses while a fine shower of mixed carbolic acid and water, produced in the simplest manner, falls upon the wound, the lint and gauze employed in the subsequent dressing being duly saturated with the antiseptic. At St. Bartholomew's, Mr. Callender employs the dilute carbolic acid without the spray; but, as regards the real point aimed at—the preventing of the wound from becoming a nidus for a propagation of septic bacteria—the practice in both hospitals is the same. Commending itself as it does to the scientifically trained mind, the antiseptic system has struck deep root in Germany.

It would also have given me pleasure to point out the present position of the "germ theory" in reference to the phenomena of infectious disease, distinguishing arguments based on analogy —which, however, are terribly strong—from those based on actual observation. I should have liked to follow up the account I have already given[1] of the truly excellent researches of a young and an unknown German physician named Koch, on splenic fever, by an account of what Pasteur has recently done with reference to the same subject. Here we have before us a living contagium of the most fatal power, which we can follow from the beginning to the end of its life-cycle.[2] We find it in the blood or spleen of a smitten animal in the state say of short motionless rods. We place these rods in a nutritive liquid on the warm stage of the microscope, and see them lengthening into filaments which lie side by side, or crossing each other, be-

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1. *Fortnightly Review*, November, 1876.

2. Dallinger and Drysdale had previously shown what skill and patience can accomplish by their admirable observations on the life history of the monads.

come coiled into knots of a complexity not to be unraveled. We finally see those filaments resolving themselves into innumerable spores, each with death potentially housed within it, yet not to be distinguished microscopically from the harmless germs of *Bacillus subtilis*. The bacterium of splenic fever is called *Bacillus anthracis*. This formidable organism was shown to me by M. Pasteur in Paris last July. His recent investigations regarding the part it plays pathologically certainly rank among the most remarkable labors of that remarkable man. Observer after observer had strayed and fallen in this land of pitfalls, a multitude of opposing conclusions and mutually destructive theories being the result. In association with his younger physiological colleague M. Joubert, Pasteur struck in amid the chaos, and soon reduced the whole of it to harmony. They proved, among other things, that in cases where previous observers in France had supposed themselves to be dealing solely in splenic fever, another equally virulent factor was simultaneously active. Splenic fever was often overmastered by septicæmia, and results due solely to the latter had been frequently made the ground of pathological inferences regarding the character and cause of the former. Combining duly the two factors, all the previous irregularities disappeared, every result obtained receiving the fullest explanation. On studying the account of this masterly investigation, the words wherewith Pasteur himself feelingly alludes to the difficulties and dangers of the experimenter's art came home to me with especial force: "J'ai tant de fois éprouvé que dans cet art difficile de l'expérimentation les plus habiles bronchent à chaque pas, et que l'interprétation des faits n'est pas moins périlleuse."[1]—*Popular Science Monthly.*

1. *Comptes Rendus*, lxxxiii, p. 177.

GENESIS.—III.

BY HIRAM CHRISTOPHER, M. D.

It is the law or property of matter that it remains at rest until disturbed by some external force. This is as true of atoms as of masses. The motion of atoms in the formation or reformation of chemical compounds is occasioned by chemical attraction, but this is virtually an external force, though it inheres in matter, because it requires opposite states or conditions in the atoms attracted and united. These states or conditions may be electrical, or something akin thereto. In any view, one atom is motionless until set in motion by the attractive force excited on it by another when within the sphere of such attraction. The attraction excited by the one on the other is certainly external or foreign to the one acted on. Hence its motion is imparted and not spontaneous. The attraction is compulsory, and the same, must be the motion occasioned by the attraction. There is, therefore, no spontaneity of motion in either matter or its forces. Their motion is imparted.

Now, between rest and motion a power intervenes and breaks up the one and gives rise to the other. This power is of two kinds—imparted or spontaneous; external or internal; accidental or inherent; or natural or supernatural. These are specifically and categorically distinct and different, and to such a degree that the one kind cannot be converted into another. In the inorganic world the power that occasions motion is imparted, because matter and its forces are inert. But the motion of living matter is spontaneous, because arising from an inherent power of which spontaneity of motion is an attribute. The motion of living matter arises, therefore, from two causes or circumstances: first, because the living organism is in union with a power during its life, which possesses inherent power as an essential attribute, and second, because this power has such an attribute independent of its connection or union with a living organism whose basis structure is dead matter. Since, then, this power maintains only a

temporary union or connection with matter in an organized form, it must be considered as a power foreign or external to the world of dead matter. It is, therefore, a supernatural power; and such a source or nature is all that our argument requires. Being supernatural, it cannot be a natural or physical force. It follows, then, that living organisms cannot owe their existence to the action, power or influence of physical forces.

If the motion of living matter cannot be regarded as spontaneous and as arising from its connection with a power of which spontaneity of motion is an attribute, can we consider it as being caused by the atomic or other changes which the pabulum undergoes in its assimilation to the living organism? To this view Dr. Beale, in one part of his work on Protoplasm, seems inclined when he says: "It seems to depend upon the changes in the matter itself, rather than upon impulses communicated to the particles from without;"* yet he says a little further along, on page 43, that "the moving power evidently *resides* in every particle" of the living matter. He must conceive this power as *inherent* in living matter; and if inherent, it must be spontaneous. As living matter is dead matter in new relation as respects atoms, are we to suppose that dead matter *acquires* new properties or attributes in becoming living? that life results wholly from the new relation which the atoms of matter have assumed in living matter? or that it moves because now under the control of, because in connection with, a power of which spontaneity of motion is an inherent attribute? On the last hypothesis only can all the phenomena of the living organism be accounted for. This is really the view of Dr. Beale; for he says on p. 116 that "it seems to me that facts cannot be accounted for *except on the hypothesis of the existence of some force or power which influences*, in a manner we do not yet understand, the ultimate elements, or the compound molecules, and *causes* them to take up particular relations to one another, so that when they combine, compounds possessing certain characters shall be formed." These compounds include every kind of organic bodies, all of which are either directly or indirectly, the work of this foreign power. What this power is will appear hereafter.

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*Page 40.

We should distinguish between the different kinds of organic matter. This distinction Dr. Beale makes very clear. He divides organic matter into 1, pabulum, 2, living matter, and 3, formed matter. When we have the simplest organism under view, we see this living matter in motion. This is the living being when enveloped by its membrane, which is "formed matter," and the product of the changes which the pabulum underwent in the organism, and possibly of the changes, as to atoms, which the living matter underwent in throwing off the formed matter. We see also the pabulum and formed matter. All the changes take place in the living matter, and are produced by the power that formed the organism, and through its functions. Now, the origin or genesis of two of these organic bodies—the first and third—can be readily and easily determined. The formed matter we see is the product of the living matter. It is formed of it and by its functions. The pabulum is formed matter, of the same genesis as the latter—the product of other living organisms. There is no other known or possible genesis for pabulum or "formed matter," and hence their origin may be considered as settled and determined. Now, if such be the genesis of these organic bodies; and as physical forces have not as yet produced even such bodies as these, it is simply impossible to believe that the organism can be the product of these forces.

That pabulum, as distinguished by Dr. Beale, is the formed matter of other living organisms, and not the germinal source of living matter, or the living organism, is evident from numerous facts. But only a few are necessary to the proof. The starch and gluten that constitute the bulk of the seeds of plants, are the products of the living vegetable organism, and are designed as food for the future plant during its period of germination, until a time when its development into root, stem and leaf, shall no longer require such a provision. When the plant has reached this period of growth, the seed will be found exhausted. These organic bodies were consumed by the living organism imbedded in them as the germ. This is a matter of observation. It is equally true that the seed of plants are made the food of animals. Formed matter constitutes the food of animals; hence pabulum is formed matter. We know by observation, therefore, the origin or genesis of all organic bodies but the living organism.

Now, whence this? Not from pabulum, since this is formed matter, and this is non-living organic matter. The failure of all experiments with formed matter in the interests of spontaneous generation, has fully and clearly demonstrated, that living organisms cannot be generated from organic matter of any kind; and the reason for the failure is plain: living matter cannot be generated from dead matter, except by a supernatural power. Dead matter, in the sense in which the term is here used, is all matter that does not present any of the phenomena of that which we call living matter. It is as virtualy dead as are the salts of the inorganic world; and hence the genesis of life is just as possible from the salt as from formed matter.

Having now satisfactorily determined the origin or genesis of all non-living organic bodies, it remains to consider further the genesis of the living. And here we meet with five phenomena which are nowhere seen but in living matter, or living organisms. They are characteristic and differential of the living substance. The first of these is, spontaneity of motion, the second, growth, the third, reproduction, the fourth, the production of formed matter, and the fifth, psychical phenomena. All these phenomena are ascribed to one and the same agent, power or intelligence, as their author; for the last are as truly the manifestation of the power that occasions the spontaneous movement of living matter, as are any, or either, of the others. The existence, therefore, of psychical phenomena in the higher forms of living organisms, proves that the power that gives rise to the phenomena of spontaneous motion, growth and reproduction in living matter, is an agent possessing intelligence. When we consider the gradual development of the organic kingdom, and observe that this living power or agent gradually manifests the phenomena of intelligence, in proportion as the structure of the organism makes this manifestation possible, we can but ascribe to the same source the spontaneous movement of living matter and the psychical phenomena of every grade and degree of the higher animals. This the modern scientist believes and teaches, though he assigns all to a material force, and calls that force vital.

Spontaneity is an inherent attribute of that which possesses it or manifests it. As matter and physical forces have it not, in any phase in which they may appear; and as the psychical phe

nomena of animals exhibit spontaneity as one of the attributes of that from which these phenomena proceed; and as these phephenomena are known to rest on a spirit basis in other beings, we must assign the spontaneous motion of living matter to that power which determines the vital relation of the atoms of matter in living organisms, and this power is *spirit*, and can be nothing else. We may, therefore, say that living matter moves *because of its connection or union with spirit,* in which these phenomena inhere, and from which they proceed.

Among psychical phenomena will, or spontaneity, is prominent. This is one of the essential attributes of spirit. It is the nature of spirit to will—to move; for will is motion or activity. Indeed, it can but move, and in motion may be included the exercise of all its attributes. It is its nature also to grow, its growth of self being an increase of knowledge—an increase, as it were, of its bulk or mass. So when united to matter, that matter takes on this attribute of spirit, and grows like spirit, from within out, increases the mass or bulk of the living substance. Hence, growth is a necessary attribute of living matter, or living organisms. As the pabulum of spirit is knowledge or thought, and as the spirit grows by this, so in this process of growth, thought is produced, but thrown off like the formed matter of the living cell, or the reproduction of itself, and as these phenomena take place under the process of thinking, spirit reproduces itself as it were, in the generation of its thoughts.* Hence, the phenomenon of reproduction of *living* organisms. It is an essential attribute of the living organisms, because a reproductive agent is in connection or union with it, and imparts to it this property. Here is the foundation, as well as the reason, for these vital phenomena observed in every living organism.

That it is *will* power that causes the motion in living matter appears still more evident from the phenomena observed in the higher forms of living organisms, whose psychical faculties most clearly discover the true and real character of this power. The actions of these animals are confessedly self-determined, or *will*-determined. Though we can see no other evidence of this power in living matter than that which is shown by the phenom-

*Mental Philosophy. Haven. p. 100.

ena of motion, growth, and reproduction, yet when we know that these only are manifested because of the grade of the organism, and that psychical phenomena appear when the organism has attained that structure which allows of the higher manifestations of the true nature of the life agent, it is not difficult to see that they prove the presence of such a power as we have here conceived of, as indubitably as do the *psychical* phenomena of the higher grades. Therefore as nothing but spirit thinks and wills, and thinks and wills because such is its nature, and must think and will, *so nothing has spontaneity of motion but spirit.* All else is inert and motionless. As matter, by virtue of its nature, must remain at rest, so spirit, by virtue of its nature, must move, think and will; and so powerful, active, and expressive is this nature, that even inert matter, when in union or connection with it, seems to acquire spontaneity of motion, and the power of growth and reproduction. But these appear only where the matter is living. They are not seen in "pabulum" or "formed matter;" only where the willing and thinking power resides. When this power leaves the organism, all living phenomena disappear. Though the organism may be preserved intact as to structure for an indefinite time, it never revives. It is said to be dead because all vital phenomena have disappeared. The functions have all ceased. When this forming, growing, reproducing and thinking power departed, all evidence of its presence and existence disappeared at the same time. Could it be made to return, all organs would again resume their functions. That which thinks and reasons and wills would again make its presence manifest through psychical phenomena. But we cannot recall it when once gone. There lies its great work, but it is not working. There lies the machine, but the power which worked it is gone, and gone forever. It is not a crystal that, once broken, may be reformed. The crystal we may grind to a powder, and make it wholly disappear from our sight by solution in a solvent; but we may recover it, and present it in as beautiful a form as ever. But this living form, when dead, is lost to us forever. It passes into the world of dead matter, and there continues. The life power is not the crystalline force. As far as that once living body is concerned, the vital agent has gone out of this world, where, human learning cannot tell us. These are incontroverti-

ble facts, and prove the supernatural origin and nature of the vital force. Between the natural and supernatural there is a wide and impassable gulf, though in the living organism they are blended for the time being.

But the modern school of scientists claim that science knows nothing of the supernatural. They disclaim all knowledge of such a realm, and deny that its assumed phenomena are legitimate objects of scientific investigation. Assumed phenomena! Who assumes that all the psychical phenomena of man are the legitimate and natural outgrowth of molecular action—of forces dynamic in "cosmic vapor," or "fires of the sun?" Assigning by assumption, and not by proof, the psychical phenomena of animals to a material origin, they protest that they know nothing of the immaterial or supernatural, and solely because they cannot by scientific methods of analysis, discover the power on which the supernatural rests. When they attempt to analyze a living organism, the living power departs on the threshold of the analysis. Not so physical forces. They remain because inseparably connected with matter. But the life agent departs by virtue of its foreign nature and origin, and remains beyond and above man's power to reach. Yet these scientists claim that psychical phenomena are indeed physical, and are careful to exclude everything that is not in their conception purely physical in its nature. If their science includes only that which they call phenomenal, and the phenomenal are only the physical, they should have excluded all psychical phenomena, or else have proved, and not assumed, their purely physical origin and basis. But this they have not done, and yet they do not hesitate to declare that mind of whatever grade or capacity, is really and wholly as much a physical phenomenon as is crystalization, or the corrosive properties of arsenious acid or the chloride of mercury. It is strange that men making, and deservedly, high claims to scientific knowledge, should seriously advocate a view of the vital force that so completely materializes one of the essential attributes of the Deity; but when one has embraced the doctrine of evolution, he has entered the field of absurdities, among which this view of the material nature of the life agent is not the least.

It is another strong proof of the wide dissimilarity between

the nature and origin of organic and inorganic bodies, that the structures of the latter are simple, whilst those of the former are, all of them, complex. The body formed by the union of several crystals of different constitution, cannot be characterized as complex in structure. Nor is the crystal form an advanced structure when compared with its non-crystal form. There is no such a thing known in the world of crystals as differentiation of structure, or different organs or parts performing different functions; yet these are characteristic of organized bodies. There is, consequently, no motion, or interchange of the atoms composing inorganic substances; yet this also is characteristic of the living organism. When we shall find salts or crystals exhibiting motion and interchange of atoms; secreting and execreting widely different substances; or reproducing their like in an infant state with capacity to grow to maturity, and repeat in itself all the phenomena of the parent, it will then be time enough to believe, or affirm the identity, as to nature and origin, of inorganic bodies and organic structures. When dead matter shall be found presenting all the phenomena of the living, then the "philosopher's stone" will have been discovered, and gold have become as plentiful and as accessible as the sand on the sea shore. Then will wealth be the fortune of all, and all poverty, and every ill which wealth can banish, will disappear from among men; then alas! the philosopher may end all by converting the world and all upon it, into one grand, cosmic Kohinoor!

But if the transmutation of material substances is a physical impossibility; if the species of matter are immutable, as they certainly are; if there is no philosopher's stone for the transmutation of metals, is it not a faith that can remove mountains, that believes that psychical phenomena are but a modification of the physical? that dead matter can assume at will, or give itself, life? But spontaneous generation is still an impossibility. Matter cannot put on the form of life by its own forces.

The existence of metals and coal in the crust of the earth, and having been placed there so many ages before man came on the earth, was really prophetic of his appearance at the proper time, and anticipatory of his wants and needs when he should appear. He is the only animal on earth that can make any use of them—that has the power and intelligence to remove them, and put

them in a form in which they may be made useful to him. Prof. Huxley thinks that a being of "sufficient intelligence," such as himself, for instance, could have predicted, while viewing the potential energies of the cosmic vapor, as he stood at a convenient distance from it, the fauna of Great Britain in any year of the present century that might be named. May we not ask, what intelligence predicted the appearance of man so many geological periods before he came on the earth by putting in accessible places the vast deposits of mineral substances found in the crust of the earth? If it requires a "sufficient intelligence" to make his prediction, could the prediction of man have required less? If it requires a sufficient knowledge of molecular action, as it appeared in matter while in the form of vapor, to predict the ultimate outcome of that action at any future period, what was the grade and degree of intelligence that conceived of all this work, and set in motion such agencies as would in due time accomplish all the purposes of that intelligence? Now, since intelligence is required for both of these predictions; and since the intelligence of Mr. Huxley's scientist is one of the results of molecular action, having its origin, possibly, in "the cosmic vapor," what molecular action gave rise to the intelligence that conceived of molecular action as a dynamic force, and set it in motion to work out certain results; whence, I ask, this primary or pro-natural intelligence? If no intelligence ante-dated the existence of "the cosmic vapor;" and if all the psychical faculties of man are the outcome of molecular action, then it must be admitted that we have in this action, a force that rises as it increases, and increases as it rises, and to whose increase and rising there seems to be no possible limit; so that we may look forward to the time when its work will develop infinite intelligence! Thus would we be told that it is rational and scientific to expect infinite intelligence in the end; but wholly foolish and unscientific to place it at the beginning!—*St. Louis Medical and Surgical Journal for March.*

METEOROLOGY IN MEDICINE.

BY J. SCHREIBER, M. D.

Translated from the "Oesterreischische Zeitschrift fur Meteorologie" by W. H. Geddings, M. D., of Aiken, S C.

The employment of climate in the treatment of disease extends back to the time of the Romans.

The invalid patricians were sent to the heights of Stabiæ, and in the summer, when the air of the Eternal City was rendered pestiferous by the miasmas of the Pontine marshes, the well-to-do inhabitants sought refuge on the health-giving shores of the Mediterranean. The remains of Cicero's summer retreat are still shown near Pozzuoli, in the neighborhood of Naples, and in Horace we find many places in which he sings the praises of the cool air of lovely Baiæ. The beneficial effects of long sea voyages in pulmonary diseases were also known to the ancient Romans. In those early days there were of course no meteorological observations; works on climatology were wanting, and the prescription of a change of residence could be therefore nothing more than a piece of crude empiricism. Eighteen hundred years have since elapsed without materially changing our views.

Within the last fifty years an endless amount has been written about climatic resorts, their peculiarities and their indications in the treatment of disease; but, unfortunately, few if any of them rest upon a truly scientific basis.

These publications contain, it is true, carefully calculated tables of the range of temperature, of humidity, and of atmospheric pressure; much about winds and precipitation, and a great deal is said in praise of equability of temperature, the clearness of the atmosphere, the luxuriant growth of vegetation, the blue skies and the charming beauty of the landscape, to say nothing of the favorable sanitary condition of the inhabitants. The perusal of these monographs, fail, however, to give us any definite idea of the real "healing property" ("heilende princip") in climatic health resorts. We are expected to content ourselves with the assurance that most of the patients who

visit these resorts (and they are almost exclusively cases of pulmonary or constitutional disease) are either cured, or, at all events, improved. Up to within very recent times the expressive phrases, "mild climate" and "southern climate," helped us out of our uncertainty in regard to a question so important for both the physician and his patient.

How very unstable were the claims set forth by various health resorts, may be gathered from the fact that places which had been praised to the skies as perfect Eldorados for invalids were sooner or later abandoned; that every nation had its favorite resort, and that the most distinguished physicians often held the most opposite views in regard to the therapeutic value of the same resort.

This state of affairs was due to the fact that physicians were too little versed in meteorology to be able to correctly estimate the various factors or combination of factors, which constitute a climate—or to criticise the erroneous statements advanced in favor of the individual health resorts. When, in addition to this, we consider the great revolution that has taken place in medicine within the last two decades, and the entire change which our ideas of the etiology of consumption and its treatment have undergone within that period, it is not to be wondered at that our conception of the term "climatic" and of "climatic resorts" should have suffered a corresponding modification. Prior to the last fifteen years the word "climatic" was considered identical with "southern," and the term "climatic resorts," was always associated with the scent of oranges and lemons, coupled with dreams of eternal sunshine, soft breathing zephyrs and balsamic exhalations.

The belief prevailed that consumption did not occur in warm countries, but the study of its geographical distribution soon demonstrated the fact that certain tropical regions in both hemispheres were frequently the very ones decimated by that disease, while the inhabitants of the arctic zones enjoyed comparative immunity. It is at last a settled fact that pulmonary consumption is neither favored by a low temperature, nor prevented or cured by a high one.

Meteorology affords ample proof that pulmonary phthisis and temperature have nothing in common.

Although that scourge of the human race is met with in every latitude, among the inhabitants of Greenland as well as among the negro races of Africa, there are nevertheless certain territories which enjoy more or less immunity. On comparing the climates of some of these, we will not only fail to find any analogy in their meteorological character, but even discover in this respect the greatest dissimilarity, as an example of which we give the temperature of the following places:

	Lat.	*Coldest month.*	*Warmest month.*	*Annual mean.*
Akureyri, Iceland	65° N.	28.40° F.	56.12° F.	40.10° F.
Orenburg, in temperate zone	51 "	3.93	69.80	35.96
Madras, in torrid zone	13 "	77.00	88.16	81.50

The great interest and vast importance of this complicated question might readily tempt me to exceed the limits imposed by the strictly meteorological character of this assembly. Omitting, then, that portion of the subject which appertains more properly to medical science, I shall confine myself to that which is capable of being considered from a meteorological point of view, but take the liberty of premising that I shall use the word "meteorology" in its widest sense, and include the chemistry of the atmosphere.

In order that we may correctly estimate the influence of meteorology in medicine, it must be stated at the outset that the latter has not as yet discovered for the physician what he has so long sought in vain, an ideal climate. The great service of meteorology, and one which should not be underrated, consists really in the correct estimation of facts, the unearthing of errors, and the establishment of unassailable truths. If you will take the trouble to glance over any one of the numerous monographs on resorts in Italy or the Riviera you will find much praise bestowed upon the equability of the climate. Now meteorology teaches us that the diurnal range of temperature increases as we proceed south, and that the difference in temperature of two consecutive days is just as great in Italy as with us (Vienna). Meteorology teaches further, that equability of temperature, that is when the term is applied to a long series of consecutive days is only met with on the other side of the temperate zone, in the region of the trade-winds and calms, and that when this prop-

erty is desired, and value attached to it, we must seek health resorts in the western portion of our continent (Europe), as on the coasts of France, Netherlands, and of Norway, or on the western coast of England. It is particularly in this direction that meteorology has done good service, in correcting misconceptions, and demonstrating that, so far as equability is concerned, southern localities are less "climatic" than those situated farther north. Regarding the subject from such a point of view, we would have to rank the coast of Norway as very "climatic." Considering this question in a strictly scientific spirit, without regard to its practicability and the difficulty of its execution, our physicians would have to turn their backs to the northern hemisphere altogether and direct their attention to the northern portions of New Zealand, where the invalid could remain the whole year, the temperature of the coldest month being 48.2° F., and of the warmest 62.6° F., with the rainfall distributed equally over the whole year, and where in addition to these advantages endemic diseases are unknown.

It is only recently, and since physicians have occupied themselves with the study of the meteorological phenomena so essential in climatic therapeutics, that they have discovered that the term "southern" is not synonymous with "warmth," and that if we are in search of warm localities in winter we may attain our object just as well starting from the interior of our continent, say from the Ural mountains, by a journey westward as southward.

You are aware, gentlemen, that during the past ten years hundreds of invalids have wintered in the elevated valleys of the mountains with just as favorable results as in the so-called southern resorts.

This conclusion was reached by observing that consumption in all latitudes diminishes with altitude, until it finally disappears altogether.

It was supposed that the rarity of consumption in these elevated regions was due to diminished pressure of the atmosphere, and upon this theory a pompous scientific structure was reared, which, however, after a little while soon fell to pieces. I must here crave your indulgence if, to make my subject more intelligible, I speak a little of things appertaining more strictly to

my own profession. The theory just mentioned died out in consequence of a revolution in our views concerning the nature of consumption.

Formerly every variety of pulmonary phthisis was supposed to be the result of a neoplasm (tubercle) developed in the lung tissue, which underwent manifold metamorphoses. It was observed, however, that many of these cases were not associated with any such neoplasm, but were dependent upon disordered nutrition, imperfect hæmatosis, and pathological processes, leading in the first place to inanition of the lungs, and then to wasting of the whole organism. The physiological effect of diminished atmospheric pressure to increase the heart's action was utilized for therapeutic purposes, and this diminution of pressure was regarded as the cause of the immunity from consumption observed in the mountainous regions of every latitude. More extended observation, however, soon demonstrated the fallacy of this assertion, for it was noticed that the altitude at which this immunity commenced varied with latitude, being higher the nearer we approach the equator, which could not be the case if the above theory were correct, the laws of diminished pressure being everywhere the same.

An inquiry instituted in Saxony, at the expense of that government, proved that elevation had nothing to do with immunity, very high localities in the Erz and Riesengeberge exhibiting a large per centage of phthisis as soon as the inhabitants turned their attention to the industrial arts, such as mining and the manufacture of china; while, on the other hand, the per centage in the low lands was diminished when the people were engaged in agriculture and cattle raising. Thus we see that science has failed to confirm the theory; the practice, however, of sending invalids to winter in mountain regions proved nevertheless a success. The ice was broken, and the old custom of seeking "mild," that is, "warm" climates, was thrown overboard. The fact thus established gave rise to renewed researches, which, while they confirmed the good results accruing to consumptives from a residence in the mountains, found that they were due to other causes than altitude.

Fifteen years ago an English physician, MacCormac, published a book, in which he claimed that pulmonary consumption

was an artificial product developed by inspiring air which had been previously expired, "rebreathed," as he expressed it. This "rebreathed air," he asserted, contained organic substances which gave rise to disease in the lungs. He went so far as to say that there would be no pulmonary consumption if every one would sleep with open doors and windows, and his first prescription was to sleep with the latter half if not wholly opened. It was a long time before his words were taken to heart; and if all physicians have not the courage of MacCormac to make their phthisical patients sleep in winter with open windows, they at least order the apartments of such invalids to be aired several times a day in the coldest weather, and allow them to walk in the open air, even when the temperature is below the freezing point.

It has been established beyond all doubt that these organic substances, be they the gaseous products of putrefactive processes in the animal or vegetable kingdom, or vegetable germs, or microscopical animalcules floating in the atmosphere, do reach the lungs with the current of air inspired, and are there capable of doing great mischief. The great hygienic value of ventilation, the object of which is not only to supply fresh air, but also to carry off that which has been contaminated with miasmas, has been demonstrated by a recent and very instructive example. During the late typhus epidemic in Vienna the physcians, nurses and others in the various Vienna hospitals, were attacked with the disease, but in the Rothschild Hospital in the suburb Währing, there was not a single case of contagion, although numerous cases of the disease were treated there. This latter is the only hospital in Vienna which is provided with a ventilator in the cellar worked with steam, by means of which the air in every room is emptied and renewed. Now Pasteur has proven that the organic substances are much more numerous near the earth's surface than in the higher strata of the atmosphere, and that they continue to diminish the higher we ascend, disappearing entirely when we reach a certain height in the mountains. We have therefore in the presence or absence of these organic substances a very important point of distinction between the air of the plains and that of the mountains. That these substances are much more abundant in crowded cities than in small

towns and villages is self-evident. Considered from a climato-therapeutic point of view, ozone and rain are intimately associated with this question. The property possessed by ozone of purifying the atmosphere depends upon its oxydizing power. While oxygen requires a considerable degree of heat before it will combine with other substances, ozone does so at ordinary temperatures. Ozone destroys the products of decomposition by chemically combining with them and converting them into other bodies. The absence of ozone, however, does not justify the conclusion that the air is necessarily bad, as it may happen that all ozone may have been expended in the oxydizing of the organic substances in it. On the other hand, the presence of ozone is proof positive that such an atmosphere contains no organic substances.

The air of the ocean and high mountains is richer in ozone than that of the plain, because the former contains little or no organic matter. Here, as in many other things, every-day experience has forestalled science. It has been the custom for quite a long time to recommend the pine woods as a place of residence for pulmonary invalids, but the "why" of the procedure has only recently been discovered. The turpentine exhaled from the pine forests possessess to a greater degree than all other bodies the property of converting the oxygen of the air into ozone, and as this latter destroys organic matter, the air of such forests must be very pure, and consequently conducive to respiration.

Whether the direct inhalation of ozone is of any advantage must still be be considered an open question. As the red blood corpuscles themselves rapidly convert the oxygen into ozone, it would appear that the latter is not required in the respiratory process; and Alexander Schmidt, of Dorpat, is of the opinion that all the processes of oxydation within the organism are accomplished not by oxygen, but by ozone, oxygen outside of the body being scarcely able at the temperature of animal heat (98.50° F.) to bring about the oxydation of highly organized bodies.

As air is mechanically cleansed by rain and snow, so it is chemically purified by ozone. Rain, as it were, washes out the atmosphere, and carries with it to the ground not only its solid

particles, but also its carbonic acid and ammonia; hence, while agriculture regards it as a capital fertilizer, medicine attaches to it a greater importance as a hygienic agent, and this, too, in direct opposition to those writers who are continually boasting of its long-continued absence at the different resorts they may chance to represent.

Medical climatology, on the contrary, claims that rain is a necessary factor, and refuses to recognize the worth of those climatic resorts where for weeks and months at a time it never rains. It must, of course, be granted that long-continued rains are disagreeable in many respects, but then this unpleasantness may be salutary, in the same way that the virtues of certain medicines are in no way impaired by their disagreeble, or even disgusting taste or smell. It remains for us now to glance at the composition of our atmosphere, which under healthy normal conditions is as a rule, as follows: 100 volumes contain oxygen, 20.81; nitrogen, 79.15; carbonic acid, 0. 04. Nitrogen plays no part in the respiration, and may hence be left out of the question. The quality of air is estimated by the amount of oxygen and carbonic acid it contains. The difference between normal air (O. 20.81) and that which extinguishes a candle (O. 18. 27), or in which man ceases to exist (O. 17.20), strikes every one at a glance; but the question has been raised whether any importance was to be attached to a slight difference, such as that which exists between two samples of air, the one containing O. 20.999, and the other O. 20.980 volumes.

Angus Smith, in his book on "Air and Rain," replies that such differences exercise absolutely no influence on respiration so long as there is simply a diminution in the amount of oxygen, which may perhaps have been expended in the formation of ozone, but that the case is otherwise when a putrid gas takes the place of the oxygen absorbed by the products of decomposition. It will be remembered that apparently trifling differences are often of great importance in chemical researches.

If we subtract, for instance, 0.980 from 0.999 we get 0.019 for 100 volumes, or for a million a difference of 190. If now our drinking water is contaminated with poison, or with some decomposing substance, which must be regarded as poison, in this proportion of 190 to 1,000,000, we get in every litre (2.113

pints) 0.19 grammes (2.931 grs.); a quantity amply sufficient to cause disease or even death.

Besides this, it must not be forgotten that the amount of fluid taken as drink is as nothing compared to the enormous quantity of air inspired. An adult takes, on average, about from three to four litres of water a day, but inhales no less than 6,000 to 12,000 litres of air. Then again, I must remind you that the impurities breathed in with the air *remain* in the blood (except in those cases where they are excreted from the circulation), and that this latter is devoid of those disinfecting properties possessed in so high a degree by the secretions of the stomach. The above-mentioned quantity would be for many poisons a truly gigantic dose, but still the proportion inhaled at each inspiration is only the two-thousandth part of a grain, or 0.0000035 grammes. How infinitesimally small is the amount of arsenic diffused through the atmosphere by our green wall-papers, and yet how severe are the cases of arsenic poisoning in persons inhabiting rooms the walls of which are covered with this paper.

I need not call your attention to the cases of lead colic among painters who use white lead, or of the diseases so prevalent among those who are engaged in pursuits necessitating the use of mercury and phosphorus. The malignant fevers of tropical regions, with their thousands of victims, arise as do the malarial fevers of our swamps, from the inhalation of air contaminated with the products of decomposing animal and vegetable matter, these latter being gaseous in their nature.

Yellow fever is caused, as has been demonstrated, by the inhalation of the spores of an alga which grows in the Gulf of Mexico. This fever never occurs at an elevation greater than 2,000 feet above the sea level, at which height the spores probably cease to find a temperature sufficiently high to sustain their vitality. For the same reason, the fever appears only during the warmer months of the year. You will see, gentlemen, that the term "climatic," which has been hitherto employed to denote a vague, indefinite specific of which no rational account could be given, appears now as something infinitely clear and very simple, being in fact nothing more than pure air, uncontaminated by miasma, with no organic or inorganic substances, and one in which meteoric precipitation (rain) is not unduly

deficient. I say "appears," because the proof is still wanting, and the researches of the next ten years may render our present views untenable. No place, however, even when it possesses the above mentioned quality in the highest degree, should be considered as suited for climatic treatment, unless it has also a number of other qualities, the discussion of which must be reserved for a strictly medical assembly.

I can not close without expressing the wish that the Central Bureau of Meteorolgy may take into consideration the propriety of extending its field of operations so as to include in the work of some of the stations the observations of the quantity of ozone and of the organic and inorganic impurities present in the atmosphere.

Journalistic.

The Dental and Oral Science Magazine is a new journal published in New York, by R. S. Williams, and edited by James E. Dexter. It is a quarterly journal, and principally occupied with the Transactions of the Odontological Society of New York. The first No. which has just reached us has about ninety pages, and is very tastily *gotten up* and presents a very creditable appearance. We hope the *Oral Magazine* may meet with all the encouragement from the profession which it deserves.

The first article in the present No. is a paper read by Prof. Flagg, of Philadelphia, which professes to embody the peculiar views of those who claim that they have made a new departure in saving teeth principally by using amalgam. In this paper Dr. Flagg proposes to give the doctrine of the "Accepted Creed" and also the opposing doctrine of the New Departists. It seems that there was a great difference of opinion between Dr Flagg and many members of the Society as to what the "Accepted Creed" was upon several points, and when the practical recom-

mendations of the New Dapartists were carefully analyzed no one could easily point out any material difference between the practice advocated by *them* now and the actual practice of the great body of the profession forty years ago. It is true that those who followed this course of practice then were much less theoretically inclined than their *confrères* of the present day, but they were anxious to save teeth and do it with as little labor and expense as possible, which of course is a very laudable ambition. Our readers are, however, well acquainted with all of the theories which have been advanced to bolster up the amalgam practice, so that it is useless to repeat them here. Boldness of assertion as to the results did not seem, however, to convince the audience, which was made up of the members of the Odontological Society, perhaps, because a good many of them had heard the same party boldly proclaim before the American Association, some ten years ago, that he could properly fill a tooth with Morgan's Plastic Gold in *two minutes and a half*, and that in practice, in as much as he saved for his patients a good deal of time by using this material, he charged them a larger price on this account than he would have charged if he had filled the teeth with foil. As he was mistaken as regards the plastic gold so he may possibly be mistaken as to the propriety of returning in practice to the method followed by our fathers. We are not advocates for *advancing* backwards in our profession. It has required a vast amount of labor by the best men of the profession to counteract the tendency which has ever manifested itself, to run into an almost exclusive amalgam practice; and to establish a healthy eclecticism in practice, which we take it is the position occupied by a great majority of the best men in the profession to day. It is true, that one meets now and then with a dentist who never uses amalgam; but if any one supposes that a majority of the intelligent dentists at this time repudiate almalgam altogether, he has bnt little knowledge of the dental profession.

We will only quote one precious gem from this unique document, New Departure No. VI: "A filling may be the best that is known for the tooth, and yet leak badly, * * * but, if even vitiated saliva leaks between tooth-bone and a material which is practically a non-conductor, and which has a surface that is

neither bright, nor oxidizable, then leakage is *proved* by *experience* to be *not* practically detrimental."

The debate upon this subject was somewhat lengthy, but only served to show that the extravagant assertions made in the paper were generally taken for about what they were worth by the members of the Society. We were somewhat surprised, however, that during the whole discussion of this question, neither in the paper referred to above nor in the next one read before the Society, which was upon the same subject by Dr. Chase, was there any reference made to the originator of the doctrine which lies at the foundation of all of these heterogeneous and illogical deductions. The author of the electrical theory of decay however little thought, when he read his paper before the Odontological Society of Great Britain, what would be claimed by others as its legitimate results. We apprehend that when this subject shall have been examined carefully and properly digested, it will be found that although electrical currents in the mouth do not play a very important part in the process of dental caries, still our knowledge of their existence and influences will be of service in enabling us to explain certain phenomena which without such knowledge we might be unable to understand. Moreover, our practice may probably be somewhat modified by our understanding of this subject. Before we shall arrive at satisfactory results, however, the subject must be examined by some one who can understand that if tissues are disintegrated under certain conditions by electrolyses, still it does not necessarily follow that no other agents can produce a similar result, and it will be necessary to resort to something more in the way of investigation and research, than the miserable caricatures upon scientific experimentations which have been brought forward to sustain the *extravaganzas* of some of the *New Departists*.

Dr. Marten contributes an able paper upon "The Relation of the Science of Physiognomy to Mechanical Dentistry," but spends his energies in vain when pleading for more attention to his department of practice. The fiat hath gone forth, and it is and ever will be fruitless to attempt to stem the tide of Destiny.

Dr. Kingsly makes a contribution upon the "Mechanics of

Speech," which is illustrated with many plates. Some extracts from the *London Lancet* and a few other sources make up the rest of the February number. As a whole the first number of the *Dental and Oral Science Magazine* is a success.

The March number of the *St. Louis Medical and Surgical Journal* is before us, and an examination of its contents convinces us that this number is fully equal to its predecessors so far as its articles of interest are concerned, and considerably excels any previous number as far as its typographical *errors* are concerned.

The *Druggists' Circular* for March has an article, which it takes from the *British Medical Journal*, entitled "Death from a Carious Tooth." It appears from a statement made that in a case of abscess of one of the lower molars in a child the inflammation extended along the dental nerve, entered the brain and hence the fatal result. The editor of the *British Medical Journal* says in regard to this case:

"This case would show how important it is to attend early to carious teeth, and to have them removed as soon as inflammatory symptoms become evident, and not to tamper with them by "stopping" or other useless means frequently resorted to by dentists, to the detriment of the patient's pockets, if not of their health or life."

We have many times wondered why it was that our enterprising papers took so little interest in anything that referred to the practice of medicine; that they suffered so much arrant nonsense to find place in their columns in relation to medical subjects, since it would be a very easy thing to employ some competent physician to overlook all such articles and rid them of their fallacious and frequently ridiculous features. But we find this mania for writing upon subjects which they know nothing about, is not entirely confined to non-professionals and the specimen quoted above from the *British Medical Journal* furnishes a a good illustration of this fact. We have noticed many decidedly rich things in the medical literature of the day upon dental subjects, but for downright stupidity this recommendation of the *British Medical Journal* not "to tamper with it, etc.," carries off the palm. It seems that the physician who treated the case

found out what was the mattsr by making a *post mortem* examination so that they were enabled to write a satisfactory *certificate* as to the cause of death. This writing of *certificates*, moreover, seems to be about the most important function which the general practitioner is called upon to perform.

If an intelligent dentist had seen the case, in all probability he would have diagnosed it without making a post mortem examination, and a *certificate* would not have been needed. If dental journals were accustomed to bungle medicine when they wrote upon strictly medical subjects as badly as many medical journals do dentistry when they venture upon this, to them, *terra incognito*, we would advise them to forever relinquish all efforts in that direction.

We hope Mr. Barnum will succeed in catching this British editor so that we may be able to get a sight of this enlightened specimen of humanity who advises his readers in this age of the world not to have their teeth tampered with by a dentist. Fortunately for our readers we are in an unusually happy state of mind at this time, everything appearing lovely without and perfect serenity reigning within, so that we have the kindliest feelings for our fellow men and cannot find it in our heart to say an unkind word of any human being. Were it not so we might in an unguarded moment say something harsh, or at least indulge in ungenerous thoughts, but we dismiss every impulse of this kind before it is fully developed and settle down to rest and quietude with an overwhelming sense of good will to all mankind. Farewell! My dear, simple old friend of the *British Medical Journal*, farewell.

Microscopy and Histology.

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It is with some hesitation that we assume the management of department devoted to Microscopy and Histology in this journal. We feel that the task will be a somewhat difficult one. It is our wish to make it a nucleus for the practical study of these subjects, and to this end we invite the assistance of those who may be interested in such studies, and offer them our pages for the publication of practical articles in this department.

We are aware that there are many men who have for years worked alone and made much advance in microscopic technology, of whom the world has never heard, probably for the reason that there has been no convenient medium of publication. We wish to afford these a ready means of communication. We wish them to communicate the means they have used to arrive at their results, as well as to give their results and deductions therefrom. We want them to give us their mode or modes of preparing and mounting the different tissues, so that others may follow them. No matter if the general plan be found in the text books, we want the minutiæ so described that beginners may follow them, in order that we may multiply the number of practical workers in this department of knowledge.

We especially invite articles on the practical study of the dental tissues, their development and their patho-histology; but we would by no means have it understood that we will be confined within these bounds. The whole of histology, normal and abnormal, is our field.

BEGINNINGS.

We believe it is common with those who begin the practical study of microscopy alone, to be discouraged in the outstart with their want of success. Well may this be the case if they have not a just appreciation of the difficulties with which they will

meet in the preparation of material. To any such we would say that a practical treatise on the use of the instrument, such as "Carpenter on the Microscope," "The Microscope," Hogg, Beale, "How to Work with the Microscope," "Frey on the Microscope and Microscopic Technology," Wyethe's "Microscopist's Manual," or some such work, is about as important as the microscope itself. When these are obtained it will be found that certain accessories are required for histological work, but these may, as a rule, be obtained when needed. The first thing of importance is to learn to handle the instrument, to become familiar with the management of light, its condensation and the different effects produced by the direction in which the rays strike the object, to become familiar with the power of the objectives and eye pieces. The objectives should not be of too high a power, nor of a high angular aperture until considerable skill be acquired. One of the best studies I know of for the beginner is that of *protophytes*, *desmids*, *confervæ* and other growths, and the different forms of life found in the ponds and ditches everywhere.

The material is always abundant, easily obtained and exceedingly interesting, and at the same time very easy of preparation. Among the animalcules *Rotifers*, *stentors*, *nois* and *analids* are found some of the most instructive lessons which the student can place under the instrument. The action of living muscles may be studied, the action of cilia in the production of currents, and their individual motions may be watched and made out better than anywhere else in nature. No other field affords so perfect an understanding of the vermicular motions of the intestines. A great variety of subjects of instruction to the histologist and physiologist is found here.

Any one can well afford to spend the leisure moments of a summer in this field of study, and at its close he will find that he has insensibly obtained that dexterity in the handling of the instrument, the lighting of objects and interpretation of subjects so necessary to further progress. One of the next best studies, and which may be carried on possibly at the same time, is the study of insects. The material is abundant, always at hand, and when one finds himself able to dissect out and mount the several different organs of the house-fly, he will have obtained a

dexterity in manipulation that will enable him to undertake to open a nerve trunk and display its individual fibers with reasonable hope of success. But these studies do much more than lend skill to the hand. The eye must become skilled as well, in order to the recognition of the several tissues with which we have to deal. The eye has entered upon a new and unknown field of work. All is strange, and there is little in histological work that can be compared to things seen with the naked vision in order to arrive at conclusions.

The instruments necessary for the dissection of insects are very few and simple. A pair of very delicate spring finger scissors is the most important and expensive; a pair of delicate pliers, a couple of needles fixed in handles, a few pins, a little piece of gutta percha two inches square, with the edges turned up so as to form a shallow pan as a dissecting trough for working under water completes the outfit.

PRACTICAL STUDIES OF THE DEVELOPMENT OF THE TEETH.

In studying the development of teeth, certain forms or processes have been found more convenient than those formerly in use. How far any of these plans have been used in this country, we do not know; but the publication in detail of some of the most convenient methods at this time will not be amiss. The plans to be pursued should be such as will produce the least change in the tissues operated upon, and it is especially important to avoid displacement of parts in order that they may be examined in their natural position. We have found the following plans the most satisfactory, though others may be employed; suppose we wish to examine the developing teeth of the child at birth. The jaws should be dissected while yet fresh as possible and placed in a solution of nitric acid, five parts of acid to one hundred parts of water, for the purpose of decalcifying it; this will soften the bone and the formed dentine in from two to four days sufficiently for cutting. Other acids may be used for this purpose; we have obtained fair results with chromic acid of the strength of 1 to 100, but it takes more time, and unless considerable time is taken to bleach the specimens they will be considerably colored, which is objectionable in this instance for the reason that all parts are colored in the same degree; while if specimens are stained at all, certain ele-

ments should be stained to the exclusion of other elements of the tissue in order that they may be more easily recognized by the eye.

During the maceration in the acid, the gas bubbles which adhere to the surface of the specimen should be shaken off occasionally. Towards the close of the process, exposed parts of bone may be tried with the knife to see how readily they will cut, in order to know how the decalcification is proceeding; when the bones give no more resistance to the knife than the other tissues it may be considered sufficiently complete, and removed from the acid. We should remark that the amount of the acid solution for the lower jaw of a still-born child should be as much as sixteen ounces, in order that it may not materially lose its strength during the process.

The specimen should now be placed in pure water, a quart or more, for the removal of the acid, in which it should remain for twenty-four hours.

We must now consider the form or direction best to cut the sections. For the incisors, the best direction is the antero-posterior-perpendicular; for this purpose the jaw may be divided at the median line; one-half may be cut between the milk molars, or if the section tubes* be large enough to accomodate it in the position desired, it may be cut at the ramus. A common pin is now stuck into it where it is divided at the median line, in such a position that when standing erect the piece will be in proper position for cutting the incisors into sections, and the piece is ready to invest.

The investing material is a matter of no small importance. For general use paraffine is the best we have tried; but when freezing is to be employed as in this case, we have found ordinary beeswax and sweet oil, one part of oil to two parts of wax-melted together and thoroughly mixed answers, better for the reason that it is not so liable to crack in the freezing, and it cuts more easily. Some advantage may be gained by dipping the specimen in thick *gum arabic* solution and letting it dry just a little before investing it; this prevents the wax adhering. Now

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* The section tube is described in all the recent works on the microscope.

after trying the piece to be cut, in the section tube, to see that it will stand just right, the plug may be removed and a temporary tube formed by wrapping with paper, and the wax and oil melted and poured in, and the piece to be cut placed in position and secured, or held until fixed and then set aside to cool; when sufficiently hard the paper may be removed and the plug with its invested piece shoved into the section tube. The piece may be invested directly in the section tube itself, but the shrinkage of the wax is liable to be enough to loosen it so that it will move in cutting. In rolling the paper on the plug it will not often be so close, but that the volume of wax will be sufficient to fill the section tube perfectly. For some time past I have thrown aside the brass plugs usually furnished with section tubes and substituted *wood* for the reason that the investing material takes a firmer hold of the wood than the metal and is less likely to break away. It is generally necessary to place a piece of sheet metal upon its lower end, for the end of the screw to act against in raising it in order to secure accuracy.

In freezing, any vessel may be used; a common bucket, or a smaller vessel is better, not requiring so much ice. Having ice pounded fine enough to cover the section tube in the vessel, place a few alternate layers of ice and salt on its bottom and place the section tube (with the piece to be cut in it) on the ice and add alternate layers of ice and salt until it is fully covered; then lay the knives to be used in cutting upon the ice and cover the whole with an old blanket and leave it to freeze. In thirty or forty minutes it will be ready for cutting. While it is freezing everything should be prepared for the cutting and after care of the section.

I have found common dinner plates serve well for this purpose. Suppose we expect to cut the central and lateral incisors from the position first chosen for investment; we will arrange two plates with a little water on them conveniently for laying the sections, and as they are cut they are laid in a circle around the first plate (the place of beginning being noticed or marked) until it is seen that the central incisor is past; then begin in the same manner using the second plate for the lateral incisor so that afterward the examination may be conducted in the proper order. The apparatus by which the section tube is secured to

the table should be in perfect readiness, and the knives in the best of order before being put into the freezing vessel. A large strong razor with as nearly straight edge as possible answers well for the purpose.

Everything being in readiness, the section tube is removed from the freezing mixture and secured to the table and the cutting commenced without delay, for if it be a warm summer day thawing will soon begin, and no time is to be lost. An assistant should be at hand to take the sections from the knife. The cutting should proceed quickly but regularly and without hurry, and the raising of the object by the screw done with regularity. The knife should be pressed very firmly to the tube plate, and pushed through the object, sliding from point to heel. The cutting may proceed until as much of the jaw is worked off as is desirable to cut in this position, viz.: the two incisors and possibly the cuspid. In case it should thaw out too much before the desired point is reached, a little wax is run over it and it is returned to the freezing mixture and frozen again, after which the cutting is continued to the desired point. At any convenient time the remaining parts of the jaw may be removed and reinvested in a more desirable position, frozen and cut in a similar manner.

Sections of the jaws of the puppy, kitten, pig, or any of the smaller animals should be treated in the same manner. After as many sections have been cut as may be convenient at one freezing, the examination should begin with the first section cut, and carried on with regularity to the last, studying each section in its order, so that everything in the jaw may be examined.

CONCERNING THE USE OF DISSIMILAR METALS IN FILLING A TOOTH.

BY A. W. HARLAN, CHICAGO, ILL.

Since it is the fashion now-a-days for everyone, be he large or small, to have his ideas concerning the practice of dentistry aired in some publication, I trust that the readers of The Journal will allow me to offer them something which has not, heretofore, been much discussed; indeed, I have been able to find but the slightest reference to it in the text-books on dentistry, and a pretty thorough search of the transactions of societies and periodical literature has disclosed nothing very valuable or scientific concerning what is to follow:

I have long entertained the opinion that it was not good practice to use gold and amalgam in the same tooth, whether the fillings were separated from each other or not. Observation has shown me that a great many dentists are in the habit of filling teeth in the above manner, and I have been endeavoring to collect a sufficient number of good reasons to convince them that it is not a very wise method of operating. I will first cite cases from my own practice, and then give my experiments on the subject.

March, 1870, filled large crown cavity and roots of lower first molar with amalgam; filled buccal cavity in the same tooth with gold; the metals did not come in contact. March, 1878, eight years afterwards, the buccal filling had to be renewed. Crown filling in good condition yet. May, 1870, filled upper second molar in the same mouth, distal cavity including roots, using amalgam; filled mesial cavity with gold. February, 1878, was compelled to refill the mesial cavity on account of the recurrence of decay around the filling. July, 1877, filled buccal cavity in lower first molar (alive) with amalgam and crown cavity with gold. August, 1873, crown filling had to be replaced, in order to save the tooth. August, 1871, filled distal cavity in upper second bicuspid (alive) with amalgam, and mesial

cavity in the same tooth with gold. September, 1877, renewed the mesial filling for the same reason that the others were refilled.

In the few cases where I have built gold up by the side of an amalgam filling I have found that as a rule *decay is likely to recur around the margins of both fillings equally*, and also where I have used amalgam to fill a cavity by the side of a gold filling the result was the same.

I ceased several years ago using two metals in one tooth, whether alive or devitalized, because I was convinced that one of the cavities would sooner or later have to be refilled. I was as much surprised to find that decay almost invariably attacked the margins around the gold filling, as any one of the readers of THE JOURNAL can be at my recording it, but such is the result of my observations, regarding my own operations and those from the hands of other reputable practitioners.

Now for the experiments: Selecting a perfectly sound tooth I filled the crown with amalgam and the buccal surface with gold, and suspended the crown in a solution of cider vinegar of one-tenth strength, allowing it to remain 48 hours. On removal it was very easy to scrape off the enamel around the gold filling, and an almost imperceptible amount of softening had taken place around the amalgam filling. Repeated the same experiment with a one-twentieth solution of vinegar, allowing the tooth to remain seven days with the same result precisely. Experimented once more, using this time a central incisor, the proximal surfaces of which were filled—one with amalgam and the other with gold, allowing it to remain suspended eight days in a one-twenty-fifth solution, with no different result.

If these experiments and practical cases prove anything, it is that *we should not expect to save a tooth by using two metals in it, for the purpose of arresting caries.* We must not for the sake of economy or of shortening an operation fill an immense cavity with amalgam and a small one with gold, but on the other hand, it would seem imperative that the dentist should fill both cavities with one material, whether it be of amalgam or of gold. I have been practising in this way since 1872, and have not, and will not fill a tooth unless I can use one metal for filling all the cavities in it. Without being sure of it, I may say that I

believe no bad results need be apprehended from using tin and amalgam in the same tooh, or tin and gutta percha or oxy-chloride of zinc, etc., but I do not use gold and tin in the same tooth when they are separated from each other by a portion of tooth substance, because the tin, if not worn out by mastication, is dissolved by the acid secretions of the mouth. I do not pretend to explain the reason why decay recurs around the margins of a gold filling when there is an amalgam filling in the same tooth, but will leave that to the experimenter with electricity.

With reference to the use of tin and gold in combination for filling teeth, I am of the opinion that if either of these metals are used honestly and thoroughly the result will be the same, that is to say, the tooth will be saved and its color will be better if the metals are used separately. I venture to hint that after the lapse of sufficient time—say three years, the combination fillings of tin and gold will begin to flake and become depressed on the grinding surface of the teeth, and the proximal surfaces turn quite black, which in both cases would be calamitous.

In conclusion it will not be presumptuous, I hope, to remark that the dentist who wishes to serve his patients best, wlll use his own judgment in the selection of materials for filling, and his own method for accomplishing the desired end, and at the same time not permit pecuniary considerations to come between him and the salvation of a tooth, remembering that it is better to save one tooth for useful service, than to miserably fail in saving a dozen teeth by following the advice or wishes of a patient, thereby confessing your want of firmness and want of judgment.

LAKE ERIE DENTAL ASSOCIATION.

The Fifteenth Annual Session of the Lake Erie Dental Association will be held at Sharon Pa., commencing Tuesday, May 7, 1878, at A. M., and continue three days. A general invitation is extended to the profession. C. B. Ansart, Sec'y.

Proceedings of Dental Societies.

TRANSACTIONS OF THE AMERICAN DENTAL ASSOCIATION.

The following abstract and review of the Transactions of the last annual meeting of the American Dental Association, is given, more especially for the benefit of those of our readers not members of the Association.

The annual meeting of the A. D. A. for 1877, was held in the city of Chicago, Dr. G. W. Keely, President.

In looking over the minutes of the Secretary we find that there was in attendance something over one hundred members, representing twenty-three different organizations, State and local societies, and dental colleges, embraced in the States of Massachusetts, Illinois, New York, Michigan, Indiana, Iowa, Kentucky, Maine, Missouri, Mississippi, Tennessee, Pennsylvania and Winconsin.

In the report of the Committee on Credentials, which was adopted, we notice the name of the Western College of Dental Surgeons as being admitted to representation. In calling attention to this act of the Association, our motives may be criticised, but we do it in all kindness, simply as a matter of right, and for the good of the Association.

We are of the opinion that the admission of any dental college which exists only on paper, has no published, prescribed curriculum or definite rules, and terms of graduation, has never held a session, and has no organized faculty, is, to say the least, establishing a bad precedent. Upon the same grounds that this institution was admitted, at least two other similar institutions in St. Louis might have claimed representation.

Section 4 of the Constitution, on delegates, reads as follows:

* * * * * Delegates shall receive their appointment only from permanently organized dental societies and dental colleges, having definite conditions of membership other than pecuniary. * * * * *

The latter clause may seem a little ambiguous to those not familiar with the early history of the Association, and the controversy between *it* and the old American Convention, for whose benefit the words, "other than pecuniary," were inserted. As this section was construed in the case of the Western College of Dental Surgeons, any dental college, duly chartered, without a faculty, course of study or terms of graduation, would be entitled to representation.

We believe that the above section needs amending so as to require a dental college to present some tangible evidence of the kind of work it is doing, or proposes to do as an educator, before it can claim representation in the American Dental Association.

The Special Committee on Sections, appointed at the annual meeting of 1876, reported the following resolutions:

Resolved, That the membership of this Association be and is hereby divided into —— permanent sections, each section to be composed of such members as may elect to unite and form that section.

Resolved, That it shall be the duty of each member of this Association to connect himself with some one of these sections, but that he shall be free to follow his own preferences as to the particular channel in which he will labor and may if he so desires be a member of two or more sections.

Resolved, That the members of each section shall at some time during each annual meeting of the Association, elect a Chairman and such other officers of the section as they may see fit, whose duty it shall be to see that the labors of the section are conducted in the manner calculated to secure the best results.

Resolved, That each section shall have charge of one of the subjects or branches essential to scientific dentistry, and through its Chairman or such other member as it may select, report upon the same to the Association at each annual meeting.

Resolved, That after the several sections shall have been fully organized and in working condition, it shall be the duty of each Chairman to furnish the latest and best information in the possession of his section upon any point connected with its subject, to any member of another section who through the Chairman of his own section may apply to him for such information.

The report was recommitted for amendment and reconsideration to an enlarged committee of ten instead of three members, report to be made at the next annual meeting. A reorganiza-

tion of the Association substantially on the plan suggested in the report, and which it is hoped will embrace the Southern Dental Association and the old American Convention, is contemplated. The last two named organizations have appointed similar committees consisting of ten members each, to confer with that appointed by the Association, for the purpose of taking into consideration, as well as making such arrangements as may be necessary to organize an American Dental Congress, at a joint meeting of these organizations to be held at Niagara Falls, commencing on the second Tuesday in August, 1878.

The following named gentlemen constitute the committees of their respective organizations:

SOUTHERN DENTAL ASSOCIATION.

Drs. S. P. Cutler, Memphis, Tenn.; J. R. Walker, New Orleans, La.; F. J. S. Gorgas, Baltimore, Md.; H. J. McKellops, St. Louis, Mo.; W. W. H. Thackston, Farmville, Va.; W. G. Redman, Louisville, Ky.; Wm. Dearson, Mobile, Ala.; E. S. Chisholm, Tuscaloosa, Ala.; G. W. McElhaney, West Point, Ga.; T. T. Moore, Columbia, S. C.

AMERICAN DENTAL ASSOCIATION.

Drs. R. Finley Hunt, Washington, D. C.; W. H. Atkinson, New York; W. H. Morgan, Nashville, Tenn.; C. W. Spalding, St. Louis, Mo.; H. Judd, St. Louis, Mo.; H. A. Smith, Cincinnati, Ohio; G. P. Barker, (dead) Philadelphia, Pa.; J. H. McQuillen, Philadelphia, Pa.; J. N. Crouse, Chicago, Ill.; L. D. Shepard, Boston, Mass.

AMERICAN DENTAL CONVENTION.

Drs. R. P. Winder, Baltimore, Md.; A. G. Northrop, New York; John Allen, New York; B. F. Coy, Baltimore, Md.; J. Taft, Cincinnati, Ohio; C. E. Kells, New Orleans, La.; R. B. Donalson, Washington, D. C.; C. King, Pittsburg, Pa.; C. F. Funderburg, Pittsburg, Pa.; H. B. Noble, Washington, D. C.

Among the amendments to the constitution offered at this meeting at Chicago, we notice the following, which is a step in the right direction:

"No dental college shall be eligible to representation in this Association which does not require *two courses* of lectures as a condition of graduation."

The following preamble and resolution passed by the Association does not seem to accord with the views expressed by some members of the profession in our dental journals the past year, in their articles on Dental Education :

Whereas, Dentistry is a specialty of the science of medicine ;

Resolved, That we esteem a sound and thorough medical education essential for the most successful practice of it.

President for the ensuing year—Dr. F. H. Rehwinkle, Chillicothe, Ohio.

The next annual meeting of the Association will take place at Niagara Falls, on the first Tuesday in August, 1878.

First among the reports of Standing Committees is one on Dental Physiology, by M. S. Dean, Chicago. This is an able paper, concise and logical in its statements and reasoning. The writer has shown himself thoroughly conversant with the literature of the subject presented. Independence of thought and opinion is one of his marked peculiarities ; exemplified in this paper by his taking a position in opposition to the views and opinions of some of the most sound and able writers of the day ; as Leber and Rottenstein, C. S. Tomes, Wedl and others.

"Does vital action play any part in producing any of the structural changes observed in the living dentine ?" To this question the writer gives an affirmative answer, and defends his position in a masterly manner.

To refresh our memories and as a sort of ground work for his argument, the doctor submits without argument a few, as he says, generally recognized facts : First, "That the dentine is either formed by the direct calcification of the odontoblasts, or is the product of the secretion of these cells ; in either case it is the result of the odontoblasts." We do not propose to discuss the point here but notice it only to enter a protest against its being given as a fact, to be taken unqualifiedly as a foundation stone upon which to build or support a theory. This is one of the hypothetical facts, of the truth of which perhaps no man has yet been able to give us positive evidence. As ossification is said to be the work of osteoblasts, so dentinification, and (amelification) is the work of the odontoblasts and amelblasts (enamel cells) but who can use absolute and incontroverti-

ble evidence of how bone, dentine and enamel are built up.

The calcareous deposits in the interior of the canaliculi, which Messrs. Leber and Rottenstein assert is purely the result of a chemical process, the writer says are as truly organic and the result of vital action as are the secondary deposits upon the inner surface of the dentine.

He reviews the arguments presented by Leber and Rottenstein to prove that the phenomena of stationary caries is not due to vital action but to friction, pressure and the precipitation of lime salts in the dental tubules after the action of acids has ceased. He notices Mr. C. S. Tome's concluding remarks on the subject of vital action in his appendix to "A System of Dental Surgery," where he says "it seems that the hypothesis of vital action must be abandoned *in toto*." He seems to think that Mr. Tomes has not exercised his usual care in analyzing the evidence upon which he has based his conclusions. Mr. Tomes founds his opinions upon the *appearances* of the zones of transparency in the living teeth as compared with the dead teeth. From Mr. Tomes' own observations, which he says have been few, he is inclined to think that the transparent zone is as constant in the decayed human teeth used as artificial substitutes, as in living teeth. Messrs. Leber and Rottenstein assert most positively that this zone of transparency is the result of the withdrawal of the lime salts, etc. Mr. Tomes himself says that "the tissues might be rendered more transparent either by the obliteration of the canals by calcification of their contents or by the decalcification of the matrix." The writer concludes that the premises which these gentlemen furnish us are at least equivocal, and that although the transparent zone in living teeth and in dead teeth may be similar "in naked eye and microscopical appearances," yet there is no evidence that these zones are chemically and structurally alike, nor that vital action may not be the cause of one, while chemical action is the cause of the other." After a further review of the arguments of Mr. Tomes in support of his theory, he says: "Finally, whether this 'cone' was caused either by a *diminution* or by an *increase* of lime salts, this removal or deposition can be accounted for only upon the theory of *vital action*."

The report concludes as follows: "I will now offer a few

facts and arguments, which, I think, will settle beyond a reasonable doubt, the fact that under certain circumstances, from the irritation produced by caries, and from other external causes, changes do occur within the structure of the dentine, which are due to vital action.

The first argument is so well expressed by Mr. C. S. Tomes, in presenting the *pros* and *cons* upon this subject, that I shall adopt his own words. He says: "In favor of the view that the dentinal fibrils become calcified, several arguments may be adduced; one is its *prima facie* probability. We know that slow progressive calcification does go on in the tubes long after the apparent completion of the dentine, and, seeing that the irritation of caries does unquestionably cause calcification to start afresh in the pulp, it seems very natural to suppose that it would have the same effect in dentinal tubes."

While it is doubtless true that secondary deposits are often formed upon the internal surface of the dentine in teeth when there does not appear to be any calcification of the contiguous fibrils, this fact would only prove that the irritation to which these terminal fibrils had been subjected, (which must be greater here than in remoter parts) had been so great as to overcome the resisting vital force in these cell processes, and to cause their ultimate destruction. But, when the stimulating influence has been less overpowering, but long continued, as, for example, in stationary caries, there are often found calcareous deposits both in the dentinal tubes and upon the internal surface of the dentine.

Now I have a single fact to present, such as I have nowhere seen mentioned in this connection, and which shows conclusively that irritation of the terminal fibres in the dentine does cause this calcification. In a case in practice, which struck me forcibly at the time, I saw some central and lateral incisors which had been extensively filed for the removal of caries when the person was 14 years of age, and 18 or 20 years before he came under my hands. I found, on examining these teeth, some slight points of decay—so slight indeed, that I felt at first doubtful as to the propriety of filling them. The patient, of his own accord, often spoke of the sensitive condition in which these teeth had remained several years after they had thus been filed. In preparing these cavities to be filled, I found the dentine of such a flinty hardness that, though I used the engine, I had great difficulty in forming them. You have all seen similar cases to this, and I mention it only because the unusual density of the dentine was here shown in a very marked degree.

Since the introduction of Dr. Arthur's method of forming spaces, and removing superficial decay, no fact has become more

generally established than that the irritation produced by the removal of superficial dentine, causes the obliteration (in a greater or less degree) of the terminal dentinal tubes; and this is beyond question due to vital action, as really as are the calcareous deposits upon the inner surface of the dentine.

If the irritation caused by the use of the file, or by other mechanical means, is capable of causing the calcification of the fibrils, we must believe, in the absence of any other rational cause, that the irritation arising from caries, when found sufficient to induce calcification in that portion of the cells lying *within* the pulp cavity, might also affect in the same manner *that part* of the cells which lies *nearer* the source of irritation.

This report seems to have met the almost unqualified approval of the Association, judging from the report of the discussion which followed the reading of it. Dr. Atkinson opened the discussion with a moderately Atkinsonian speech, in which he called attention to some principles that seemed to him to have been overlooked in the paper. They were being mislead by the words of the writer into thinking that chemical action is not vital action. Vital action and chemical action, one power, differing only in degree. The building up of tissue and the taking them down, is the manifestation of power, differing only in degree.

GOLD *VERSUS* AMALGAM.

Mr. Fletcher sends us the following reply to our query as to the cause of failure in the case of amalgam fillings published in the February number of THE JOURNAL:

MESSRS. EDITORS:

In THE JOURNAL for February 15th you ask why certain amalgam plugs leaked, seeing that they were made of an amalgam known to be good. The positive statement that the amalgam was properly manipulated is open to very considerable doubt, and I think if the plugs are available it could be easily proved. Any ordinary alloy amalgam not containing an excess of silver requires about one part by weight of mercury to four of filings, and the plugs referred to, if heated to redness, ought therefore to lose not exceeding one-fifth of their total weight.

I had some plugs sent for examination a few days ago which were made by an operator who was quite clear in his own mind that he knew precisely how to make a good amalgam plug, and was astonished at his partial failures. The plugs contained for every ten grains of fillings six grains of mercury, i. e., more than double the proper quantity, and they had evidently never been in proper contact with the walls of the cavity. The necessary preliminary lining of the cavity with a small quantity of amalgam, using a small ball-faced burnisher, had never been done. When I called attention to these points I had great difficulty in making him *permit himself to see* that he had not worked in a proper manner. This is a similar case to the one referred to by you and I could only persuade my acquaintance that I was right by taking some of my own waste cylinders and assaying them before him—side by side with his own.

THOS. FLETCHER.

In the case we cited the fillings were made with what the manufacturer calls "Stannous Gold." Without stating that it was "known to be good," we assumed it to be so from the positive assertions of the manufacturer; for ourself we are inclined to the opinion that "stannous gold" is greatly inferior to many of the alloys now in use. We also assumed that "the amalgam was properly manipulated" from the well-known character and ability of the operator who inserted the fillings, and from our personal acquaintance with him. The old plugs are not available; hence we cannot put them to the test which Mr. Fletcher suggests, but we think the failure in this case was not due to faulty manipulation, but to the kind of material used. We are more and more convinced from daily observation that there is some fault somewhere in amalgam fillings which render them as a class much less reliable as tooth preservers than good gold fillings. We hope the advocates of amalgam will trace out the cause of failure in amalgam fillings and give us a remedy upon which they will *all* be agreed. Then, perhaps, we can make such fillings universally as good as gold. E.

Dental Society Meetings.

CALIFORNIA STATE DENTAL ASSOCIATION.

The Ninth Annual Session will be held in San Francisco, commencing Tuesday, June 4th, 1878, at 10 o'clock A. M., and continue four days. Honorary and corresponding members are most respectfully requested to "manifest a disposition to advance the science and art of the profession" by mailing to the secretary, at least thirty days previous to the next annual session, an Essay on any subject pertaining to our specialty.

H. J. PLOMTEAUX, Sec'y.

MISSOURI STATE DENTAL ASSOCIATION.

The Fourteenth Annual Session of the Missouri State Dental Association will be held at "Sweet Springs," Mo., commencing June 4, 1878, at 10 o'clock A. M., and continue four days.

At the last annual meeting, the executive committee reported as follows, on topics for discussion, and names of essayists for the meeting in 1878, which was adopted.

Treatment of Exposed Pulps, L. C. Wasson, Kansas; Treatment of Pulpless Teeth, W. H. Schulze, Kansas; Mechanical Dentistry, D. J. McMillen; Irregularity, its Causes and Treatment, W. N. Morrison; Dental Education, W. H. Eames; Dental Literature, H. Judd; Status of Dentistry, G. A. Bowman; Cleft Palates, H. H. Keith; Microscopy, G. V. Black, Ills.

The executive committee will spare no effort to provide ample facilities for conducting the clinics, which will be made a special feature at this meeting. The subject of Microscopy and Histology will be beautifully illustrated with the aid of the stereoscopticon. Members of the profession in this and adjoining States are most cordially invited to be present.

W. H. EAMES, Sec'y.

H. E. DEPP,
J. C. MCCOY,
HOMER JUDD,
W. H. EAMES,
} Executive Committee.

KANSAS STATE DENTAL ASSOCIATION.

The Seventh Annual Meeting of the Kansas State Dental Association, will be held at Lawrence, Kansas, in Odd Fellow's Hall, commencing Tuesday, May 7, 1878, at 10 o'clock A. M.

A cordial invitation is extended to every member of the profession in this and adjoining States. It is hoped that this will be one of the most interesting meetings the Association has ever held, and members are particularly requested to bring with them any papers, reports of special cases, or anything that may be of interest or instruction.

Members who cannot reach Lawrence by 10 o'clock, Tuesday morning, should make an effort to be there Monday afternoon or evening, so as to participate in the opening of the meeting. Reduced rates will be secured at the Ludington House.

——— WM. H. SCHULZE, Sec'y.

IOWA STATE DENTAL SOCIETY.

Next meeting at Iowa City, on the first Tuesday after the Fourth of July. The question of locating the Society permanently has been made a special subject for consideration at our next meeting.

Dentists from other States are cordially invited to attend.

I. P. WILSON, Cor. Sec'y.

ILLINOIS STATE DENTAL SOCIETY.

The Illinois State Dental Society will hold its Fourteenth Annual Session, at Rockford, Ills., commencing Tuesday, May 14, 1878. It is expected that this will prove one of the most interesting and instructive sessions ever held by the Society. All dental practitioners in Illinois and adjoining States are invited to be present. EDGAR D. SWAIN, Sec'y.

INDIANA STATE DENTAL SOCIETY.

The next Annual Meeting of this Society will be held at Indianapolis, June, 1878. J. A. TURNER, Sec'y.

EASTERN INDIANA STATE DENTAL SOCIETY.

This Society will hold its next Annual Meeting at Knightstown, on May 14th, 1878.

Editorial.

ILLNESS OF DR. McKELLOPS.

Our readers will be pained to learn of the severe illness of our worthy confrère, Dr. H. J. McKellops, who has been confined to his bed for nearly three months past, with an exceedingly painful disease, (rectal abscess). He has undergone four operations, at the hands of Prof. Gregory, without a murmur; the last one, on the 11th inst., which was exceedingly painful, Dr. Gregory thinks will afford him permanent relief. Although suffering greatly except when under the influence of hypodermic injections of morphiæ, he has lost none of his characteristic, fire and zeal for his profession. Calling on him a few days since, we found him examining Dr. King's New Automatic Plugger, which he had just received from his friend Dr. Dunlevy, of Pittsburg. On expressing some surprise that suffering as he was, he should *manifest* so much interest in an instrument which he could not use; holding the plugger in his nervous grasp, he said: "Mac. will die with the harness on!" We hope in our next issue to able say to our readers, Mac. is himself again.

CARBOLIZED CAT-GUT.

We are indebted to Mr. C. Sauer, of Berlin, for a quantity of Carbolized Cat-gut for root filling, such as recommended by him in his paper published in THE JOURNAL, January, 1878. We shall give it a trial and our readers shall know the result. E.

St. Louis Dental Society's report and other items for this month crowded out.

MINNESOTA STATE DENTAL ASSOCIATION.

The Minnesota State Dental Association meets at Winona, May 26, 1878. C. M. BAILEY, Sec'y.

THE MISSOURI

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A MONTHLY RECORD OF MEDICAL SCIENCE.

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ON SOME FORMS OF DENTINE CALCIFICATION WITH NOTES ON THEIR BEARING ON DENTAL PATHOLOGY.

BY CHARLES S. TOMES, M. A.

To the end that our observations and searchings after truth may be fruitful and yet not wasteful of labor, it is essential, from time to time, to map out the boundaries of our knowledge, and, with no less exactitude to define the areas of our ignorance. Such is the purpose of my paper: I have little that is absolutely new to offer, almost nothing that has not been published elsewhere; I can only hope to put forward, as clearly as in me lies, a few matters for thought, for discussion, and—what is a hundredfold more worth than either—for observation.

But as some of the most significant facts of dentine development have been too recently published to be generally known or to have found their way into text-books, I must briefly describe the several methods in which healthy dentine is built up.

To take first ordinary hard unvascular dentine, such as we know in the human tooth.*

It was formed by the calcification of a specialized layer of cells—odontoblasts upon the surface of a pulp. The pulp, vascular and nervous, is encroached upon by this calcification proceeding inwards from its surface on every side; and as the odontoblast layer creeps inward, so do the vessels and the nerves (the large ones at all events) recede inwards before it.

So that when the dentine is complete it contains no blood-vessels, no large nerves; nothing soft but the axial portions of the odontoblasts, which persist as the dentinal fibrils.

With this we may compare the development of typical vaso-dentine.

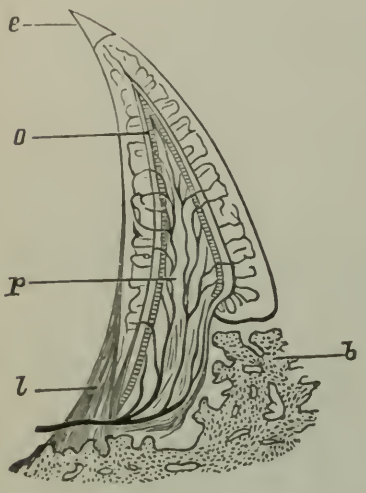

Fig. 1.—Longitudinal section of a tooth composed of Vaso-dentine (Hake) somewhat diagrammatic.

b, Bone of jaw.

e, Tip of enamel.

l, Ligamentous hinge by which it is attached.

o, Odontoblast layer.

p, Richly vascular pulp.

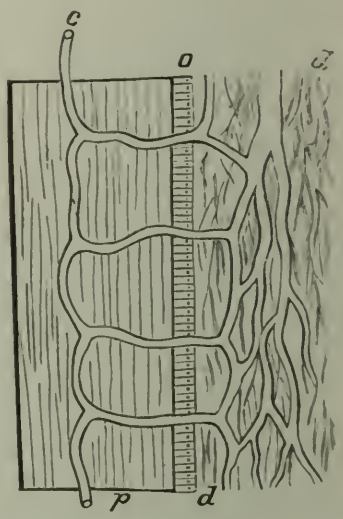

Fig. 2.—Section of Vaso-dentine more highly magnified (from Hake.)

d, Dentine containing no dentinal tube.

o, Odontoblasts.

p, Pulp, from the larger vessels of which capillaries (*c*) pass into the substance of the dentine.

*A much fuller account of the varieties of dentine and their development is contained in a paper by the author, on "Vascular Dentine." (*Philosophical Transactions of the Royal Society, 1878.*)

At the outset there is an exactly similar dentinal pulp; a richly vascular* papilla, the capillary plexus of which is but little beneath its surface, which latter is clothed with an odontoblast layer. Calcification takes place in the odontoblasts, and the odontoblast-layer creeps inwards, but in place of the capillaries receding before it, they remain in position, and become enclosed in the calcifying dentine. Here they remain pervious, and red blood circulates freely through them, just as it did when they formed part of a soft papilla.

In other words calcification has gone on right up to the capillary, so that it has no pulp-tissue around it, but lies in a bony channel of the same calibre as itself.

In typical vaso-dentine no dentinal tubes exist, for calcification goes on in the several odontoblasts to the entire obliteration of any axial channels. But there are many intermediate forms of dentine between typical unvascular dentine and typical vaso-dentine; thus in the flat fishes the apex of the tooth is hard dentine, merging by degrees into vaso-dentine at the base, the dentinal tubes becoming fewer, and finally absent, while vascular canals begin to occur.

Among mammals the great extinct Megatherium had a rich capillary plexus in the dentine; while the Manatee and Tapir have regular but scanty vascular channels in their dentine.

There is yet another variety of dentine, termed Plici-dentine in which an appearance of much complexity is arrived at by foldings of the odontoblast layer of the pulp; but the difference between this and ordinary hard dentine is more apparent than real.

In Hard Dentine, Vaso-dentine, and Plici-dentine, which we may term the true dentines, we have this in common; the hard structure is a product of calcification of a superficial, highly specialized layer of cells—the odontoblasts.

But in the next variety, Osteo-dentine, there is a great and radical difference. Like the others, it commences by the formation of a thin skin of calcification on the surface of the papilla; but here the resemblance ceases. From the interior of this first skin there shoot down throughout the papilla calcifying

*Nothing is known of its nerves.

processes, which inosculate with one another. By these is the body of the tooth formed, and a specialized odontoblast layer has nothing to do with it. So that we can pull out the pulp from a hard dentine tooth, or a vaso-dentine tooth, at any period of its growth; but you can not pull it out of an osteo-dentine tooth, save at the very first, because calcification has shot through and through it.

Fig. 3.—Section of an osteo-dentine tooth (Pike) with the pulp *in situ*.
d, Shell of hard dentine.
p, Pulp-tissue.
t, Trabeculæ of ossifying material shooting down the rough pulp.

From the foregoing very brief account it will be seen that the formation of osteo-dentine has little in common with that of other or true dentines; nevertheless these divergent forms of calcification may occur in one and the same tooth-pulp, as is exemplified in the teeth of the sheep's head fish (*Sargus ovis*), in which, after the formation of an upper half of hard dentine, a basal portion of osteo-dentine is developed from and in the same pulp.

There is yet another form of calcification of dentinal pulps—that in which globular masses, more or less completely aggregated together, are produced.

Of the details of this process we know absolutely nothing;

it is the means by which the pulp cavity is finally occluded in such creatures as the sperm whale; it is known to occur in injured pulps of creatures in which it is otherwise abnormal, and it occurs in pathological growths.

The relation of globular calcification to normal dentine development is beautifully illustrated by the tusk described by me at the last meeting of the Society. There an injured pulp struggled on, producing what was not normal, but yet was a fair similitude of a normal tusk in outward appearance; it receives a second injury, and can do no more thenceforward than form a number of isolated globular calcifications, many of them as large as a swan's egg.

And it must not be forgotten that these globular calcifications differ more in size than in kind from calcospherites, which can be artificially formed out of the body.

It would seem, then, that we might place these several forms of calcification of dentine pulps in a scale, passing from hard dentine as the highest, through vaso-dentine and osteo-dentine to globular dentine as the lowest and least specialized.

This is in some degree borne out by what we find in such morbid growths as odontomes; in these I have found vaso-dentine differing from the normal dentine only in so far that capillary tracts persisted in it; then beyond that, farther from the normal tissues, osteo-dentine, and beyond that again globular dentine.

In other words, the tissues produced as morbid structure in the human tooth are normal structure in certain other teeth—like the famous definition of dirt, they are merely matter in the wrong place.

When, in excavating a cavity, we expose a living and fairly healthy pulp, we cover it in, and, did we but know how, should take measures to induce its calcification at that point; on the other hand, when a patient comes to us suffering neuralgic pain traceable on the sound tooth, we, after excluding certain other possible causes, say that it is due to a calcifying pulp. Now, wherein lies the difference between this beneficent calcification we pray for, and the maleficent calcification we know not how to combat?

Here is a lack of data; we need observations upon the pulps

of teeth that have been painless, and upon those that have been painful, carried out with strict accuracy and attention.

As a suggestion, as a mere starting-point for observation, something to this effect might be put forth.

When calcification takes place normally in the odontoblast-layer, the vessels and nerves recede before it, so that they cannot become involved in it; when, however, calcification, deserting the odontoblast-layer, appears more deeply in the pulp, as it often does in the form of globular calcification, it is likely that nerves and blood-vessels, which have not receded before it, as in the other case, would be implicated by it, and pain result.

Now, there are very good grounds for believing that normal odontoblast calcification is a process easily upset, and that odontoblasts once destroyed on the surface are not readily reproduced if they are at all; and if the above suppositions be true, they have a bearing upon the treatment of cases of exposed pulp.

For if odontoblast calcification be the only thing that is useful to our purpose, then that copious sponging of the point of exposure with undiluted carbolic acid, which I suppose all of us have practiced with some assiduity, was labor very much misapplied, for carbolic acid coagulates the albumen and shrivels up the odontoblast, tanning it and rendering it incapable of further development. In fact, if my hypothesis be true, in exact proportion to the efficacy of our application will be the mischief we have done.

On the other hand, if any form of calcification that will block the hole will be painless and answer the purpose equally well, then we need consider nothing but the patient's comfort at the moment, and use any remedy we please, in the confidence that slight maltreatment of the exposed pulp will do nothing worse that induce a lower and ruder form of calcification.

In my own practice I have lately met with a case of severe neuralgia, especially affecting the occipital region, which was caused by globular calcification of the pulp of an upper molar, which had gone on to such an extent that there was but little room for pulp-tissue left; yet the few threads remaining were sufficient to cause intense neuralgia; and to remove all doubt as to the correctness of the diagnosis, I may add that this has hap-

pened to two teeth in the same mouth within a year with precisely the same result.

The teeth were not extracted, the remnant of pulp having been destroyed by numerous dressings of arsenious acid, and the globular masses, which were loose, but roughly fitting the pulp-cavity, got out with no small trouble.

To recapitulate, it is my belief that calcification going on in the odontoblast-layer to any extent will probably be painless, for the nerves will, as in ordinary dentine growth, recede before its advance; on the other hand, globular calcifications starting deep in the pulp and in tissue-elements other than the odontoblasts, are likely to press upon nerves, and so cause pain; these globular masses being practically foreign bodies in the pulp. It would take long to determine this point by the cases which fall under the observation of an individual, but if a dozen of my hearers would for a year take every opportunity of making observations, my hypothesis would be either negatived or confirmed.

To turn to another subject, it is a matter of well-grounded belief that the dentinal fibrils may, under certain conditions of irritation, become calcified, so rendering the dentine solid and homogeneous. This is believed to happen when a surface of dentine has been for a long time denuded of its enamel coat, or, in favorable cases, after caries has been polished away.

It is believed also to happen in that transparent zone which intervenes between caries and the pulp-cavity, though there are points in reference to this not yet thoroughly cleared up, and which can only be cleared up by very minute and very troublesome investigations. But a little light is thrown upon the subject in an indirect way by the structure and development of typical vaso-dentine.

In this, as I have before remarked, the pulp is coated by odontoblasts just like those of a human tooth-pulp, but instead of the axial portions remaining uncalcified as dentinal fibrils, the whole thing calcifies, and the dentine produced is an impervious mass, with no tubes in it.

This impervious dentine forms the exterior of many teeth, and has no enamel coat to protect it. As a curious instance of compensation, not wholly germane to my subject, I may men-

tion that the vaso-dentine tooth of the trunk-fish (*Ostracion*), which is peculiar in having its capillaries very close to the surface, leaving no room for an impervious layer of any thickness, has a thick coat of enamel instead.

To my mind, the probability of calcification occurring in the human dentinal fibril, and so solidifying the dentine, is heightened by the occurrence of solid dentine in a large number of fish, the formative organs (odontoblasts) being to all appearance quite similar in the two cases. But probability is a very different thing from proof, and I am painfully aware that my paper proves nothing at all. But if I have done ever so little in the way of showing that a favorite study, that of comparative odontology, is capable of offering hints and suggestions for thought to practical men, and so rescuing it from the charge of having no real usefulness save as a mental exercise, I shall be well content.—*Odontological Society Transactions.*

GENESIS.

By HIRAM CHRISTOPHER, M. D., of St. Louis.

The argument from design is an old one, but none the weaker on that account. It proves that intelligence lies behind design. The watch, for instance, was designed to note the hours of the day, and it does this by virtue of its mechanism. The motive power is the spring. The mechanism properly adjusted will accomplish the object designed. But the watch did not make itself—did not originate spontaneously. Nor does the spring move the mechanism of its own will. Elasticity is a physical property of the steel. The wisdom of the designer is displayed in the proper use of his material. Such a use of instruments is an evidence of intelligence. Much more is the preparation of the material of the instruments. Had man never come upon

the earth, the vast deposits of mineral could not prove design, nor be regarded as prophetic of his advent. To one capable of appreciating their use, and who has a knowledge of the beings then on the earth, their existence is the clearest evidence of design. It could not possibly have required less intelligence to design these uses than it has required to detect and apply them. Now, if the intelligence which has detected the use of mineral substances, and applied them to the wants and comforts of mankind, is the outcome of molecular action of "the cosmic vapor," may we not inquire what was the source or origin of the intelligence that placed these substances upon the earth, and adapted them to their special uses? And further, if the action of the molecules of matter had the power to give origin to the psychical faculties of animals; if intelligence comes from the natural or regular action of the molecules of matter, can we suppose that it did not require intelligence to give them this power, and to conceive and design a mechanism that could produce such a result? Either this, or we must affirm that someting can arise spontaneously from nothing; that a stream may rise higher than its fountain; or that a conclusion can be drawn from premises with which it has no connection or relation whatever. When we can generate intelligence from heat, or light, or electricity, or crystalization, or any other physical force, it will then be rational to suppose that the intelligence of man is the legitimate result of molecular power, so potent in "the cosmic vapor," or "fires of the sun." But intelligence has never been discovered in salts or crystals, however complex or beautiful. Unmistakable psychical phenomena appear only in the higher forms of animals, whose structure and differentiation of organs and functions are in a corresponding measure and degree to these phenomena. Such a complicated machinery as a living being, with all its harmonic development, is a much stronger evidence of intelligence and design than is any mechanism ever designed and constructed by men. If, then, a human mechanism is an evidence of intelligence, much more must the series of organized beings be a proof of intelligence and design. The scientist of the materialistic school ascribes living organisms to the vital force, and very justly, when we have a proper conception of the vital agent, but very unscientifically, if this agent be specifically the same as to

nature as the physical forces, heat or chemical affinity, or the force of crystalization. There are no traces of design in crystals. There is no purpose to be attained by their structure. There is no trace of *will* in any physical force; but the simplest organism develops design in the phenomena of growth and reproduction. When phenomena are so widely different, and specifically and categorically distinct, the source and nature of their cause must be equally distinct and different.

The question of spontaneous generation can be best determined at the microscopic extremity of the organic kingdom; for here the two kingdoms of nature are in the closest proximity; *the real nature of the cause or basis of psychical phenomena*, at the other, in the organism of man, in whom psychical faculties reach their highest organic perfection, and attain the plane of their highest capabilities through a material body. That there is in man anything more than what is purely animal, the legitimate production of the vital or organizing agent, the phenomena presented by his organism do not inform us. If he has what the world call sand believes to be an individual spirit, separable and distinct from his organism, and capable of an existence, and actually existing, after the death and destruction of the organism, is a matter in regard to which we may form conjectures, but of which we can have no positive information from the light of nature. So far as the question under consideration is concerned, it is not necessary to know. It is enough for us to know, and have admitted by materialists, that man presents us with a high grade of psychical faculties, and a wide range of psychical phenomena; and that these are the production of the vital agent. If he is but an animal, our argument will be the stronger; but so far as our present purpose is concerned, we care not to know whether he is more or not. Animals afford us all the data we need. They have psychical faculties the same in every respect as those of man, and they are confessedly the outgrowth or production of the vital force. As respects these faculties we may look on man as but an animal and no more.' The degree or grade of their development does not constitute a specific difference as to nature or origin.' The modern scientist, indeed, looks on man as but an animal, and our argument does not require that we shall remove him to a higher category. In the present discus-

sion, therefore, we look on the psychical phenomena of man as resting on the same basis as do those of the animals below him. This is as far as the light from natural phenomena may lead us.

Now, if man be the creation of physical forces, it is evident that there can be nothing in him which was not potentially in these forces. If he presents psychical phenomena, then is intelligence but latent in these forces. This is what the scientists of "the cosmic vapor" school believe and teach, holding that, as by the force of crystalization crystals are produced, so by the vital force living organisms are produced; that the phenomena are different only because the action of the forces differ. In one case we have crystals and in the other living organisms. This is a strange conclusion from the phenomena presented by crystals and living organisms. In the first we have invariably uniformity of structure, though complex in one sense, yet essentially simple. They have no organs nor functions beyond physical properties. On the other hand living organisms are distinguished by features of a reverse character. In these are found growth and increase in every direction; and in the highest forms phenomena appear which are entirely absent from the lowest. This fact cannot be explained on any hypothesis that does not ascribe to the vital agent a nature specifically different and distinct from that of any physical force.

Man is confessedly the most completely differentiated and the most perfectly developed living organism of the entire series. He is the climax of organic possibilities. He combines and epitomizes all the differentiations that preceded him. He is the microcosm of the macrocosm. This has been demonstrated from the structure of his organism. Hence in him organs and functions are complete as to the degree of possible development. In him the functions of organic structure have attained their possible limits. Therefore mind in him has reached its highest possible development through or in an animal organism. To the discharge of this function the brain is assigned as the instrument. Mind is but a phenomenon or attribute, not the entity itself. There is a something that thinks, but it is not the brain. When the body is dead the brain, though intact, is no longer a thinking instrument, or a thinking power. If it thought, it ought to think until disintegrated. But no one claims that the brain thinks. It

is a something that is foreign to the organism that does this.

Mind increases, and grows, and enlarges. This phenomenon appears under two aspects: 1st. It is developed *pari passu* with cerebral development of the animal. 2nd. It grows or increases in the individual animal. The first we call organic, because dependent on the development of the cerebral organ. In the second growth is individual, because intelligence in the individual is in a certan sense individualized; the personal intelligence operates only through the personal organism, and grows by knowledge. Hence we find intelligence increasing in the individual. The individual or personal mind grows and enlarges. This is an inherent attribute. Mind grows, as I have said, because such is its nature. The being that thinks, does so because such is its nature. It grows likes its organisms—from within outward. It grows by the assimilation of the proper nutriment. It imparts the power of growth to the organisms which it creates. Hence *their* growth. That which thinks, feeds on thought, just as the living cell feeds on organized pabulum. It generates and throws off thought as its natural product, as "the formed matter" proceeds from the living processes of living matter. Hence the living processes of living matter, or the living organism, are but the counterpart of the natural processes that take place in spirit substance that gives origin to living organism. The visible represents the invisible. The phenomena of the world are only the avenues by which mind finds access to mind; by which mind here looks into mind beyond, and reads the thoughts and purposes of the mind that designed and executed this wonderful fabric we call nature.

That the phenomena of nature display mind there can be no doubt. They put the highest powers of man to the severest test to read and understand them. Great as is the work already accomplished by men, they are still but on the threshold of what will yet be known. If the highest capacities of man have been severely tested by the little that he has already attained—and we may make this little as much and great as we wish—what must be the capacity, and range, and power of the Mind which designed and executed this wonderful and complex fabric of mixed being? In the phenomena of the world that great Mind has expressed his thoughts, and when man has learned to read and understand these,

he will know what that mind thought and designed. The task has not been an easy one. In these phenomena man has found a foreign language, and it was long before he could learn its symbols, and understand their meaning and power. In these phenomena, moreover, there is no apparent connection or continuity. Our words are as connected as our thoughts to those who understand our language; but the language of natural phenomena is the wildest jargon until its symbols are mastered. These phenomena are not methodically, or systematically arranged. Though they have a connection and close dependence on each other, yet their relation is not readily perceived or discovered. It is known only after close, patient, and protracted investigation, and even then we attain but an imperfect view of the thoughts of that being who speaks through these phenomena.

Since the phenomena of the world appear so chaotic, and seen distributed over the world without order or purpose, it is no small work that men have done to show how these phenomena stand related to each other, and each to all; how under all this seeming chaos and purposeless mingling of phenomena, there lies one of the most beautiful systems imaginable—one of the grandest displays of order, design and purpose, that has ever greeted the vision of the human mind! The grasping and grouping of a large number of facts and numerous phenomena, and presenting these in a connected view and sytematic relation or arrangement—the classification of all these in order and systems, are evidences of mind of the highest order and cultivation. If, then, the mind of man has done this work after the most laborious and protracted investigation, can there be any doubt as to the fact that mind is the author of these systems in nature? It cannot be that the author of this wonderful fabric is less than the student of this work; that the effect can be greater than the cause. As man has mind, so must the author of the world be an intelligent being. This conclusion is evident and incontrovertible, necessary and imperative. It was a great achievement to show the natural classification of the animal kingdom; but it was a much greater work to show that all the animals that have lived, from the beginning to the present, can be comprised under four general heads or branches, and thirteen or fourteen classes, or subordinate branches. Such harmony and consistency, continuing

through so many vast ages, and in the midst of almost infinite diversity of species, could not have been the result of chance or accident, or of dead matter and its forces.

The human mind has followed the footsteps of the life-agent from the earliest period of living organisms on the earth; has traced them through every stratum of the earth's crust; and in the end has gathered up all the facts and arranged the vast mass in order and system, and in this shown how the great Worker has developed the systems of organized beings, and in the structure of man epitomized all that preceded him. The macrocosm appears epitomized in the microcosm. The student sees in the organisms that preceded man a system complete, less the supplement that the human organism presents; and in the latter he sees the capital and the epitome of all that went before. By this great work the human mind has entered the mind of the great Worker, and there read the thoughts and purposes developed in the end by the appearance of man. In this vast and beautiful system of organized beings the human has read the divine mind; has grasped its thoughts and purposes, and thus shown and proved its identity with the mind that conceived and executed this vast system, whose initial point was so remote that the science of numbers cannot calculate its distance, and yet so completely epitomized by the present inhabitants of the earth, that the whole appears in the present. "In the prosecution of modern physical sciences" man has demonstrated that human reason is congruous with that reason of which the material universe is the product; for when we say (within certain limits) we understand the scheme of the world as to its structure and as to its dynamics, we affirm that the mind which understands and the mind which has produced this scheme of things, are in unison, or that they are convertible the one into the other."* That is to say, that the mind of man and the mind of the Creator are of the same nature or essence; that mind, whether human or divine; whether human or purely animal, is the attribute of the same substantial essence, and rests on, as its basis, the same nature and entity. This being so, the conclusion is unquestionable, and the position impregnable, that the life-agent which has pro-

*Taylor's World of Mind, p. 327.

duced, in living organisms, psychical phenomena of the same nature, essence, and kind as those presented by mind wherever existing, can be none other than the one great Spirit who is the author of life wherever existing, and in whatever existing. And as no man has ever shown, or even attempted to show, that physical forces are either of a psychical nature, or capable of giving rise to psychical phenomena in the faintest degree, we can but conclude that these phenomena owe their existence to a power or agent that is wholly supernatural; to a power foreign to, and wholly independent of, the realm of the inorganic world. Therefore, as we may justly ascribe to the same source or origin the motion, growth, and reproduction of the simplest living organism and the psychical phenomena of animals; and as man's mind is the same in nature, essence, and kind, as the Mind which conceived and executed this vast fabric of matter and life, we reach the indisputable conclusion that this world and all that is in it, owe their existence to a Power intelligent, and wholly foreign to matter and its forces. Such is really the view of Dr. Beale in the work which suggested these papers. On page 132 he says: "For behind all this structure, operating now one part of the mechanism, and now on another, is *mind*, the *will*, the *thinking power itself*," and then asks, but does not answer, "What is the nature of this [power,] and how does it act upon the mechanism?" What its nature is we have approximately, at least, determined; *how* it acts on the organism—how mind and will and thinking are manifested in and by such mechanism as the animal organism, we cannot determine. We know nothing about it, and probably, if not certainly, never will know. As a fact, however, it is no more difficult of belief, or of being understood, than the action of physical forces on matter. The demonstration of the existence of psychical agent or power is no more difficult than the demonstration of the existence and action of physical forces. The existence of each is proved by the phenomena which they display. But *how* either acts on matter is a matter of no practical moment. The fact exists; and though a knowledge of the *modus operandi* of the action either of spirit or of the forces of nature on matter, be impossible, and may ever be so, this ignorance will not alter or annihilate the facts.

But the *mental* phenomena of animals do not exhaust the

resources of our argument. These are not the only manifestations or attributes of psychical beings, such as we have in the higher species of animals, and in man when contemplated as but an animal. There is in animals not only a *mental* nature; but also a *moral* nature. The modern scientist makes a distinction between a mental and moral action. The distinction is not arbitrary. It is natural and necessary. A mental action has a moral quality or character. It is good or bad or indifferent either inherently or circumstantially. This is well understood and believed as respects the action of man; but it may seem startling to some to ascribe a moral nature to the actions of animals. It is, nevertheless, true that animals have a *moral* nature, and this is an absolutely necessary conclusion from the premises that the psychical faculties of animals arise, or rest on, the same nature or basis as do the psychical faculties of other intelligent beings. In man the moral nature is so highly developed and conspicuous that some have regarded it as peculiar to man, and differentiative of the human species. But this is an exaggeration of the difference between men and animals of the higher species; but so long as the modern scientists regard man as the product of a physical force, they must also regard him as but an animal. If but an animal, and he has a moral nature, this fact is all our argument requires. If but an animal, then there is in animals a moral nature, and it is as much the duty of the scientist to account for this as for any other phenemenon.

But animals have a moral nature. There can be doubt of this; for when they "fight with one another, when they associate for a common purpose and when they warn one another in danger when they come to the rescue of one another, when they display pain or joy, they manifest impulses of the same kind as are considered among the moral attributes of man. The range of their passions is even as extensive as that of the human mind, and I am at a loss to perceive a difference in kind between them, however much they may differ in degree, and in the manner in which they are expressed. The gradations of the moral faculties among the higher animals and man are, moreover, so imperceptible, that, to deny to the first a certain sense of responsibility and consciousness, would certainly be an exaggeration of the

differences which distinguish animals and man."* Since, then, animals have a moral nature and display, in some instances, moral emotions of a very marked degree of strength and permanency, we must conclude, if the doctrine of evolution be true, that love and hatred, joy and sorrow, justice and injustice, mercy, compassion, benevolence and such like, were like art and science, poetry and painting, philosophy and oratory, "potential in the cosmic vapor," or "latent in the fires of the Sun." Out of heat, light and chemical affinity have come the mental and moral faculties and emotions of man and animals! Whence then, the mind and wisdom, the love and mercy, justice and holiness of the Great Author of all? Is the love which attracts two individuals a modified chemical affinity? Is hatred which repels them, allied in nature to electricity? Is the social affection only a mode of cohesion? the glow of gratitude a kind of heat? Is there no distinction in any direction except that of degree, mode or form? All these things must be true, if they are but the ultimate outcome of evolutionary forces. There must be but one unbroken series of phenomena, all arising from the same or kindred forces, if psychical phenomena, of every kind and degree, are but the ultimate outcome of the power of physical agents. The modern scientist sees no further back than his cosmic vapor, and no other power, than what was in that fiery mist. All that exists was potentially there. Out of that vapor have come metals, and salts, and crystals; plants and animals, and all mental and moral phenomena! What a herculean faith! It is no longer a hyperbole of speech to say that the faith of some men may remove mountains. Here we have a faith that believes that water will flow upward! That a stream can rise above its source.—*St. Louis Medical and Surgical Journal for April.*

Agassiz's Essay on Classification, pp. 96-97.

Translations.

THE INFLUENCE OF THE CHEEKS AND TONGUE, AND THE LIPS AND TONGUE ON THE GUMS AND JAWS.

BY C. SAUER.

[*A Translation.*]

The pain following extraction of the teeth, upon which I published a paper in the year 1874, in the *Deutsche Vierteljahrsshrift für Zahnheilkunde,* has given me occasion to make further observation of known physiological processes, and the influence exerted by the lips and tongue, and cheeks and tongue, upon the gums and aveolar ridge. I take occasion to present the following short consideration of pain after extraction.

Pain immediately following extraction of teeth deserves our special notice on account of its severity; it is sometimes much more severe than the toothache was before extraction.

For us dentists it is all the more important for the reason that patients believe that we are to blame for it. We must therefore give it our closest attention. Heretofore we have been quite powerless against it. We looked only to the irritation of the broken nerve in the maxilla or an induced ostitis as the cause. The pain might arise from these causes, but in my cases ostitis only has occasionally been present. I have always found the seat of pain in the border of the gums corresponding to the edges of the aveoli. The gums always rise above the bony walls of the alveoli, and in these cases the pain arises as soon as the gums are pressed against these margins. There is no pain in the alveoli. As in these cases there is little or no blood clot, I unite the absence of this with the painful gum at the alveolar margin, for in such a case I am of the opinion, that there being no counteracting pressure from within the alveolus against the tongue and cheeks, or the tongue and lips, these press the gums

in over the sharp alveolar borders and thus give rise to inflammation.

A few days pass during which patients suffer without seeking aid, and then it is found that the margins of the gums are so bent over the alveolar processes from either side that they almost touch. Occasionally the pain comes on soon after extraction; this seems to arise from the inflammation of the gum about the diseased tooth before extraction; this is seen especially in cases of pericementitis. In such cases it is easy to understand how the inflamed gum may quickly become painful under the direct action of an irritant. We may also understand how the gums alone may become painful without the necessity of attributing the cause to a broken nerve in the many cases of exceeding painfulness of the gums that may be induced about a loose piece of a root. In such cases we certainly cannot attribute it to an injured nerve.

The treatment of pain after extraction should be upon the above theory. Remove the hurtful influence of the tongue, lips and cheeks. In the milder cases this may be done by filling the socket of the tooth with loose pledgets of cotton. These have been made use of heretofore but they were saturated with iodine, laudanum, etc., and it was supposed that the benefits were derived from these medicaments. If the pain be great, over-capping the gums so as to ward off the lips and tongue will be beneficial. Together with plugging the alveolus, a cut in the gums, corresponding to the border of the process will be found useful—this seems of value when ostitis is also present; by this course the gums are scarified. I also use moist warmth as an aid in the treatment.

The unpleasant influence of the movable parts of the mouth on the gum, in the manner above described, is best observed after the extraction of the lower wisdom teeth. This may also be shown in many cases besides at the margins of the gums on the borders of the alveolar processes—sharp cusps of teeth under the gums—breaks in the alveoli, and bony borders after resection show it very often, as do foreign bodies in the gums, as fish-bones, broken pieces of tooth-picks, etc. Calculus may also be an occasional cause.

Cases of pain following the extraction of the wisdom teeth

have, on account of the great movableness of the neighboring tissues, directed me to the observation of this class of cases, and aroused me to prosecute their study. It was through this that I came to connect the cause of pain after extraction, and the cause of the pain which occurs so frequently in the cutting of the wisdom teeth. It is my opinion that the wisdom tooth does not cause pain so much by pressure upon the gums in its effort to pass through, as heretofore supposed, as by the dragging of the gums across the cusps of its grinding surface. In this view of the case a cross cut down to the grinding surface, or a removal of the gums over the tooth, will be of advantage. By this means the neighboring soft parts will be prevented from draging and pressing the gums against the cusps of the tooth. Of course this does not include those cases in which trouble arises from pressure against the next tooth in front. I also hold that in the cutting of the milk teeth severe inflammation of the gums may be caused in the same manner as in the cutting of the wisdom teeth.

The coming of the permanent teeth sometimes suffers irregularity which I ascribe, at least in part, to the influence of the lips, cheeks and tongue. In the shedding of the milk teeth it is the rule that they fall out, or are removed as soon as the coming permanent tooth is level with the gums. The front teeth show themselves, as a rule, just behind the milk teeth, the back teeth immediately beneath them. The irregularity of which I have spoken occurs only in case the milk teeth fall out before the permanent teeth have reached the height of the gums. This premature shedding I ascribe to fungous growths of the gums, which I believe to be caused by pressure against the edges of the absorbed surface of the milk teeth, which in these cases grow in under the milk tooth and loosen it prematurely; finally the fungoid growth entirely breaks up the slight hold of the milk tooth and causes it to fall out. At this time the permanent tooth has reached the height of the bony border of the alveolus beneath the gums. After the loss of the milk tooth the gums close quickly over the coming permanent tooth; within two or three days only a slight slit is seen over the coming permanent tooth, which is already beginning to unite, through which a sharp instrument can scarcely be passed without injury. The lips and

tongue have here induced a condition which retards the cutting of the permanent teeth. In the shedding of the milk molars we find in such cases the gums stretching like a band from the prominences of the alveolar border on either side across between the adjoining teeth.

If in such premature shedding of the teeth, the neighboring teeth, on one or both sides, have been exchanged, then it may happen that these take too much room and the new tooth which comes through later, not finding sufficient room, must take a wrong position. Heretofore we have done nothing to correct this, probably because it was supposed that the tooth was not sufficiently developed to come forward; this however is not the case. In such cases we often see the corresponding tooth on the opposite side, which has not been retarded by the gums, taking its place in the arch. As the development of the corresponding tooth is usually equal, we must suppose that the retarded tooth is equally well developed.

The treatment is very simple when the cause is understood. I hold the borders of the gums open by a tent of cotton; occasionally I make room by a cut and prevent its healing by the use of tents. If the coming tooth be over grown by a band-like gum, I cut this through and cauterize it with nitrate of silver and also introduce tents; the wound must be kept open for some time. Since adopting this treatment I have been surprised to see such teeth coming rapidly forward.

We occasionally see a milk tooth still remaining in the row of permanent teeth in persons who have passed the time of shedding. The corresponding permanent tooth has, from some cause—as its position—been held back in the maxilla. Hitherto, if such a milk tooth was removed for any reason—as on account of pericementitis—we gave ourselves no trouble about the retarded permanent tooth, especially if there was sufficient room in the arch for it to come forward. After the observations I have made as to the cutting of the permanent teeth at the time of shedding, I notice closely the roots, and also the alveolus of such teeth, and if I find the least absorption of the root, or can feel in the depths of the alveolus the crown of the delayed permanent tooth, I hold the alveolus open by tents.

There have been cases in which the jaw had remained tooth-

less for years, and in which at last a retained permanent tooth made its appearance. I have observed two such cases. In these I saw the belated permanent teeth come through the gums in persons 35 and 40 years old, and who had worn artificial teeth on toothless and rootless gums for 5 and 10 years. These teeth were, in the one case, a cuspid, in the other a right superior bicuspid, each of which came through the gums and assumed its proper position in the mouth. I ascribe the final eruption of these belated teeth to an irritation of the gums which had extended to the peridental membrane. The bone was brought to a condition favorable to the coming forward of the retained teeth, perhaps through growth of its spongy parts. In both of these cases the irritation seemed to have been caused by the base of the artificial teeth, partly through its movements in chewing and partly through the continued influence of the tongue, lips and cheeks.

The disappearance of the alveoli, and the closure of the gums over them may also be ascribed in part to the influence of the cheeks and tongue. The alveolar borders are in this wise pressed together and the gums pressed over them until they come together and unite. After the disappearance of the alveoli the alveolar ridge takes—under the influence of the tongue, lips and cheeks—a V or roof shape. In toothless mouths this is especially noticeable in the lower jaw. Here the tongue and cheeks are continually lying against each other. In the upper jaw the form is correspondingly more rounded. The roof form (sharp ridge) in both upper and lower jaw is seen more in the position of the back teeth, while it is more rounded in the position of the cuspids and incisor teeth. The cause of this is to be found in the position of the tongue, which lies more in the deeper parts of the mouth, and is brought less forcibly against the lips.

By the unequal pressure of a poorly fitting denture on the lower jaw, the union of the cheeks and tongue with the jaw, at a point corresponding to the back teeth, can be considerably raised up; it may be owing to the inclination of the patient to avoid this unnatural pressure by means of his cheeks and tongue, *i. e.*, drawing them backward. The cheek and tongue then form a fold or flap that covers the jaw. A well fitting plate, worn patiently, can force this covering back into place.

The plate must be worn from a month to a year, or even, it may be, for a longer time. By the help of the plate the soft parts give away, allowing it to rest upon the unusually shrunken jaw. This point of union, then, is found to be lower down, or, in its normal place. The base of the denture must, of course, be now renewed. According to this we must admit that the use of a well fitting set of teeth, can both hinder an immoderate shrinking of the jaw, and oppose a too great influence of the cheek and tongue.

The object of this paper is to point out how manifold changes may be brought about by the influence of cheeks and tongue and lips and tongue in certain conditions of the gums and jaws, and to recommend further observation and reporting of cases of this nature.

Microscopy and Histology.

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A DISCOLORED ROOT.

We are in receipt of a tooth from Dr. Hurtt, of Peoria, of which he writes: "Here is a specimen which I think a rare one on account of the discoloration of the posterior root. The tooth was extracted to-day from the mouth of a gentleman aged 38 years; fleshy, healthy, etc. The tooth was first filled by Dr. Guncle, of Davenport, about ten years ago. It gave trouble. The filling was removed; pulp destroyed and refilled with gold. Two years ago filling failed; was refilled with amalgam by a dentist of Peoria. The tooth was removed on account of continued annoyance from chronic peridental inflammation. It had lost its antagonist."

The tooth, a lower molar, contains a large amalgam filling occupying crown and anterior surface. The posterior root is of an irregular blue black color for about one-half its length, begin-

ning about the eighth of an inch from its apex. The root was sawed off at junction with crown; the first fourth of pulp canal was found filled with cotton. A piece of nerve broach, about one-fourth of an inch long, was found in the canal, the lower end of which was about one-eighth inch from the apicial foramen; canal, which was rather more than medium size, otherwise open. Two sections were cut lengthwise of the root; the walls of the pulp canal were jet black as far as the end of the broach.

When ground for microscopic examination some of the tubules were found blocked with coloring matter their entire length. The greater number were clear for most of their length, but filled next the cementum.

A large number of the tubules terminated by a peculiar irregular enlargement, which we have heretofore called cauliflower terminations, but perhaps a wheat head with beards represents it better; it certainly does in this instance. Very many of these enlargements were filled with coloring matter.

Our theory is, that the infiltrations into the root-canal furnished the sulphur to slowly convert portions of the broach into sulphuret of iron. When gases were formed the fluid was expelled at the apicial foramen, leaving a residue of sulphuret. As the cavity and canals refilled with fluid by the absorption of the residual gas, this fluid carried before it the sulphurets, and in this manner the color was carried into the extreme ends of the dentinal canals. Hence, the color.

PRACTICAL STUDIES OF THE DEVELOPMENT OF THE DENTAL TISSUES. NO. 2.—EXAMINATION OF SECTIONS.

In the examination of the sections which have been laid out on the plates, we should carefully follow the order, beginning with the first section cut, and observe everything in the jaw, in order that we may keep in mind the position each section occupied before cutting; otherwise the ideas we obtain from the examination will be vague and much less valuable than they would otherwise be.

We think it well to examine them first with an ordinary magnifying glass held in the hand, as they lie on the plates. A general idea of the relation of the parts may thus be obtained that will be of much value. With this instrument alone we will be able to make out those sections which most perfectly illus-

trate the tooth germs and membranes, and separate them from those that illustrate the interspaces between the teeth; the general forms of the germs; their sacculi; their connections with the other structures; the form of the bone, the connection of the other tissues with it. In fact, the entire outlines of the subject may be better studied with a good hand magnifyer than with the microscope. This we insist upon as of supreme importance to the beginner, for without an intimate knowledge of the coarser anatomy—the outline, the relative position of the parts—an examination with higher powers will be comparatively valueless. The student must take this course in order to know positively what particular portion he is examining with his higher powers. Without such preliminary examination he will inevitably fall into the error of examining parts without knowing their relations, and thus fall into errors of interpretation and fail to obtain that definite knowledge of the subject, sought. After the examination with the hand magnifyer the sections may be transferred to slides and examined with the lower powers, then with the higher.

The bone will be seen to hold the sack containing the tooth germ in a cup (the alveolus) which comes well up around its sides and is covered over by embryonal tissue and epithelium, the latter being heaped up into a ridge directly over the tooth germ.

The most conspicuous object in the tooth germ, is the cap of formed dentine, very nearly in the form of the letter V, in the midst of the sack. Within and below this (toward the bone) is the pulp of the germ, bordered with a layer of odontoblasts which in a majority of the sections will appear as a condensed covering for the pulp, formerly called the *membrana eboris*. In order that the individual odontoblasts may be seen, the section must be exceedingly thin and the cut parallel with their length. It therefore happens that only particular portions of a few sections will show them. They will appear as a single layer of elongated cells with processes, with one end to the pulp and the other to the dentine—the processes projecting into the dentine.

The reason why these cells appear in so few sections will be plain when we consider the form of the tooth, and the necessity of the cut being just parallel with their length. In many sections where the dentine has been displaced, the processes of the odon-

toblasts will give the pulp the appearance of being covered with hair.

Outside of, and covering the dentine, but usually detatched from it by the solution of the formed enamel, will be found the ameloblasts or formative cells of the enamel, which occupy the same relation to the enamel that the odontoblasts do to the dentine. Their processes are short, and they are attached to a well defined membrane—the enamel membrane, which forms the boundary of the enamel pulp. The enamel pulp invests the structures described on all sides except the base. It is composed of a very delicate structure of stellate cells. Still proceeding outward we find a marked condensation of tissue, forming the outer bounderies of the enamel pulp and the margin of the sack containing the dental germ.

These different tissues should be closely studied, being careful to keep their relations well fixed in the mind until each tissue can be recognized at sight, whether it be in position or not. When this has been accomplished the student will be ready to begin mounting his sections.

If the attempt at mounting is made before the tissues of the different parts are readily known from each other, and their relations well fixed in the mind, the student will not be able to adjust the sections properly upon the slides, nor to replace displaced parts which he will find especially essential in this class of specimens. The pulps of the germs are liable to be misplaced from the most trivial cause, and the enamel membrane especially, is liable to be hid under or over the other tissues, and the cap of dentine to fall away and require replacement.

HANDLING SECTIONS.

This should be conducted with great care, especially sections of the jaws which are so liable to fall apart. This must always be done under water, or some other fluid medium. It cannot be done in air. For lifting sections of this character we have found a circle of sheet metal, with a handle attached in the form of a tiny ladle, the most convenient. This circle may be about one inch in diameter, perfectly flat, and very thin. This instrument may readily be slipped under a section as it lies at the bottom of the dish, or the section may be floated upon it with a needle point or pliers, and gently lifted from the liquid and

transferred to another dish containing the mounting fluid, or if desired, directly to the slide for examination, in which case it will be found that enough of the fluid has been lifted to serve to float the section off the ladle.

By a little experience, sections of even the entire eye may be handled in this way without seriously displacing the parts.

REMOVING AIR BUBBLES.

Sections cut by the freezing method are always found to contain more or less air in the form of tiny bubbles in the interstices of the tissues. These must be gotten rid of as a preliminary step to mounting; for this purpose the sections selected for mounting should be transferred to a separate dish for the purpose of removing these bubbles. The fluid media will differ with the plan to be adopted. The best means is the air pump. In using the air pump for this purpose my favorite plan is to place the sections in pure glycerine, *then carefully float a stratum of alcohol on the glycerine.* (It will be found that they will mix very slowly.) This is placed under the receiver and the air exhausted. The air in the sections expands and the sections float up to the alcohol when the bubbles will mostly leave the section and escape through the alcohol. Whereas if only one medium be used the sections will float to the top and but a few of the large bubbles will burst and not much progress be made. The removal of air is usually a tedious process at best, and the exhausting of the air must usually be repeated many times before the sections will be found ready for mounting. If an air pump be not available we may adopt the slower method of maceration in alcohol, or a mixture of alcohol and glycerine and allow the sections to stand until the bubbles have disappeared, which will require an indefinite time—a few days, or may be some weeks. There is perhaps no other point that will tax the patience of the microscopist more than these air bubbles.

MATERIALS FOR MOUNTING.

They may be briefly mentioned as follows: Glass slides, covering glass, asphalt varnish, or Brunswick black, demar cement, camel's hair brushes, needle points fixed in handles for adjusting sections, and a turn-table.

Glass slides of the regular size 1x3 inches may be obtained

from the dealers with ground edges, or the microscopist may cut them himself from any suitable glass (scraps of fine mirror can always be obtained from furniture dealers at a very trifling expense that will make excellent slides). The edges may be ground or not, according to fancy.

The thin glass covers or circles must be obtained from the dealer. Asphalt varnish can be obtained from the druggist and answers well for sealing on the covers, but we prefer the demar cement. To prepare the demar cement dissolve one ounce of gum demar in one ounce of spirits of turpentine. The gum should be rubbed up with the turpentine in a mortar and allowed to stand twenty-four hours or until clear, and then poured off. Fine oxide of zinc is then rubbed into this solution until the proper consistency for use has been obtained, which requires about one ounce of the oxide. Various colors may be made by adding carmine or lamp black or other insoluble coloring matters. We think this cement the best we have tried for glycerine mounting.

Various forms of the *turn-table* are described in works in practical microscopy. It consists of a table about three and a half inches in diameter with an arrangement for fixing the glass slide and whirling it, for laying on the cement around the circular covers. The covers may be sealed on without it, of course, but its use saves much time and contributes to the neatness of the slides.

MOUNTING MEDIA.

The media in which objects may be best displayed and kept should be well considered. These have been narrowed down to a very few; indeed, there are but two that seem much used at present, except for some especial subjects. These are glycerine and Canada balsam. We have no hesitation in saying that sections of the developing teeth should be mounted in glycerine. There is less shrinkage of the soft parts. This is of more importance here than in most other tissue sections, for the reason that the formed dentine and the bone do not shrink perceptibly even in Canada balsam, while the soft parts do shrink very much. This disfigures such sections—indeed, converts them into mere caricatures of what they once were. This is mostly prevented by the use of glycerine. The balsam renders certain parts of the structures too transparent for easy observation. Many other sections,

however, are much best mounted in balsam, as sections of the dentine, enamel, bone, some special preparations of the odontoblasts, ameloblasts, the tooth pulp, and many other structures. Indeed, sections of special structures may generally be well displayed in balsam, but mixed structures generally do best in glycerine.

Glycerine may be used pure, or with an admixture of alcohol or distilled water. It may thus be diluted one-fourth part, one-third, or even one-half, and still answer the purpose well. In all cases where alcohol is not used a piece of gum camphor should be kept in the bottle of glycerine, or glycerine and water, as without this precaution a peculiar mold is sometimes developed in the glycerine to the detriment of the section. Enough camphor will be dissolved to prevent this.

Mounting in Glycerine.

The sections may be mounted in cells or without cells. For this class of objects the best form of cell is that known as the built-up cell. It is made by fixing the glass on the turn-table and laying on a ring of cement with the camel's hair brush. If the cement be not too thin a sufficient thickness may be laid on at once, but generally several coats must be put on, each being allowed time to dry. The ring should be built just high enough so that when the section is laid in and the glass cover laid upon it, the margins of the glass cover will touch the ring all around. The cell is then filled with glycerine and the section adjusted and examined to see that all parts are right, and the cover (its lower side being moistened by breathing upon it) laid on gently and allowed to come down very slowly in order that the parts of the section be not displaced by the disturbance of the liquid, and to see that no air-bubbles are included. The cover is finally pressed close and the superabundant glycerine carefully dried away, the slide readjusted on the turn-table, and a fresh layer of cement laid on so as to cover the edges of the covering glass. After twenty-four hours the slide may be washed, and when dry another coat of cement should be applied and the mounting is complete. It may now be striped with various colors of cement, if desired. If the varnish should spread too much it may easily be pushed back into shape by the use of a tiny spatula, by laying its point on the glass and slowly pressing the varnish or ce-

ment into the form desired while the slide is being rapidly revolved. Of course this must be done while the cement is perfectly fresh. Sections may be mounted without the built-up cells, by simply placing them on the slide with a sufficient quantity of mounting fluid, and laying on the cover. Carefully wipe away the superabundant fluid and lay on a ring of cement, just touching the edge of the cover. If the first ring laid on has taken hold of the cover at all points, which it may generally be made to do, it may be laid away for twenty-four hours and then be carefully washed and dried (the cover will be easily displaced), and another coat of cement applied. This may be repeated until it is deemed sufficient.

In mounting a series of sections there will often be found, if care is used in looking for them, little scraps of the enamel membrane, with a few groups of ameloblasts attached, fragments of the pulp showing advantageously some odontoblasts, a few odontoblasts attached to stray slips of dentine and the like, that make most excellent specimens of these parts mounted alone.

The microscopist should be always on the alert for such accidentals, and when such are observed secure them at once or they will be lost. It will also be well to display a pulp alone, and different parts. A piece of bone that has been cut unusually thin and has broken away, may show the osteoblasts to especial advantage. The finest illustrations of the osteoblasts in our collection were obtained from the maxilla of a kitten while studying the development of the teeth.

In mounting for a private collection it is not necessary that each slide should illustrate the entire subject. If a particular section illustrates one point in a superior manner, it is worthy of careful mounting; for instance, one section may illustrate the enamel pulp well, while all other parts are faulty, or the odontoblasts, the ameloblasts or the tissue of the pulp may be illustrated in a superior manner. Such sections should be mounted and labeled accordingly.

MOUNTING IN BALSAM.

Many of the scraps of sections of the developing teeth may be advantageously mounted in balsam. Every one should try both plans and form his own judgment as to the desirableness of each.

My favorite mode of proceeding in using balsam is to first im-

merse the sections in alcohol, in which they should remain from twelve to twenty-four hours, to remove all traces of water, which is essential before placing in balsam.

The balsam should be moderately thick, so that a gentle heat is required to make it run freely. A little is taken up on a glass rod and transferred to a slightly warm slide. A section is then taken from the alcohol and floated carefully on the surface of clove oil. The alcohol evaporates from the upper surface and the oil enters from the lower, and the section is so stiffened that it will be much easier handled. It becomes more and more transparent as the oil penetrates. It should be carefully watched, and as soon as it sinks it should be transferred to the balsam on the slide, and the cover, the lower side of which has been wet with clove oil layed on and pressed down under a gentle heat, and held until the balsam has hardened sufficiently to prevent it from rising. Great care should be used not to heat too much, as it shrinks the section and will raise bubbles that are not easily removed. Little springs may be formed from wire to hold the covers down while drying. If the balsam used be very thin they will be necessary.

It is then laid away to dry, which will require more or less time, according to the condition of the balsam—from one to three weeks. After it has hardened sufficiently the superfluous balsam may be scraped or cut away with a knife, washed with ether to remove the rough edges of balsam, and then cleaned with powdered pomace stone, tripoli or other suitable powder. Turpentine may be substituted for the oil of cloves for replacing the alcohol, but we think it shrinks the tissues rather more. A solution of gum demar in turpentine may be substituted for the balsam.

Journalistic.

The St. Louis *Clinical Record* for March, gives renewed evidence of vitality. It is a very modest journal, as evidenced by the following notice which appears upon the frontispiece of each number:

"All who are interested in medical progress, who prefer a journal fully alive to the events of the day, and fearless in its attacks upon error wherever found, will subscribe to the *Clinical Record* and keep their bills paid up. St. Louis is now the acknowledged medical center of the West, and the *Clinical Record* is its *representative journal.*"

The *Clinical Record* has sixteen pages of reading matter, in which it treats of fractured femurs, criticising Frank Hamilton's method of treating them; gives Louis Bauer's method; eulogizes Hodgen's splint; pitches rough shod, as usual, into Louis Sayre, and handles, without gloves, the St. Louis Health Commissioner; and besides all of this, discourses some about medical matters. The *Clinical Record* man don't believe in being forced to live up to the requirements of the *code* of the Americal Medical Association, as he wishes to be entirely independent, and the journal is "a thoroughly independent medical journal."

The *St. Louis Medical and Surgical Journal* is a monthly, each number containing eighty pages, which are filled with scientific and practical articles upon all branches of medicine. The March number contains a very interesting article by Simeon E. Bucknell, upon Alcohol, which endeavors to prove that alcohol does not directly act as a stimulant, but that the acceleration of the heart's action upon the administration of alcohol is due to a paralysis of the sympathetic nerve center, and consequent dilatation of the capillaries, or as the doctor states it: "In the normal state the heart has to overcome the resistance offered by the contractile force of the capillaries. If, however, this resistance is suddenly removed, we would naturally expect

an increase in the number of pulsations per minute, with a decline in the volume and force of the pulse, and this is just what does take place." In another place the doctor says: "That all the blood-vessels, and especially the capillaries, contract on their contents, and that this contractile force is an important element in accomplishing the circulation of the blood is, I believe, generally admitted." Other writers, and among them Richardson, of London, as well as Dr. Bucknell, are exceedingly careless in speaking of capillaries, and the small veins and arteries, as if they were all subjected to the same laws, and were all contractile structures, but no one before has, to my knowledge, expressed himself in such a way as to explicitly declare that the "capillaries, especially, contract on their contents," but when we find this mixing up of these terms by other authors, we are led, in most cases, to conclude that it was through accident or carelessness, and that they were well aware that, strictly speaking, the capillaries did not contract at all. It is true that Golobew asserted that he had succeeded in producing contraction of the walls of a capillary vessel by electricity, but Billroth states, that after having witnessed Golobew's experiments, he did not think he was warranted in making the assertion. The capillary walls are doubtless elastic, and when distended may return by virtue of their elasticity, to their normal condition, but there is no evidence that they contract upon irritation of the sympathetic or any other nerve filament, though the minute viens and arteries undoubtedly do contract in consequence of direct nervous stimulation. Still the capillaries may be dilated in consequence of paralysis of the nerve center of organic life. There can scarcely be a doubt but that the muscular fibers on the walls of veins and arteries are in their normal condition in a state of partial contraction, so that the vessels are somewhat contracted, and this partial contraction is dependent upon their constant innervation, and if this innervation ceases through a paralysis of the supplying nerve, or any other cause, a dilatation of the small vessels takes place, allowing the blood to reach the capillaries with greater force when dilatation may take place in the capillary vessels. If the nervous influence is restored to the muscles of the veins and arteries, they forcibly contract and restore the vessels to their normal calibre, and the pressure upon the capil-

laries being removed they are restored to their normal condition by virtue of their elasticity, which has nothing in common with a vital contractility, such as takes place in the other vessels.

We call attention to these points lest our readers, whilst learning this doctrine in regard to the action of alcohol, should imbibe, at the same time, physiological errors in relation to the capillary system, which might easily lead to serious errors in practice.

In relation then to this view upon the action of alcohol, we would say that it seems to be pretty well substantiated by experiment, and then if we accept this as true we can scarcely refrain from acknowledging that he is also correct in stating that alcohol is a veritable poison. He also concludes that it does not increase the heat in animal bodies, but that it is a true sedative and actually reduces the heat in animal bodies. He thinks it should be given to determine the circulation to the surface when that is desired and to increase the secretions. With many other writers he concludes that alcohol is innutritious, and that it is eliminated finally from the system without having undergone any chemical change.

Another article of considerable interest to all professional men is upon "Medical Experts as Witnesses in Courts of Justice," by F. T. Ledergerber, Esq., of St. Louis. A study of these articles, several of which have appeared in the *St. Louis Medical and Surgical Journal*, would lead us into the intricacies of law farther than we propose to venture at the present time, but there is one question in relation to expert witnesses which has been much discussed and which even now is not entirely set at rest. Can an expert witness be compelled to testify in a case before a court like any other witness? Many judges have decided that they can be compelled to do so, but we notice lately some authoritative decisions which deny this doctrine. Let us examine this question for a moment and see what it amounts to. In the first place an expert witness is one who is not supposed to know anything about the case to be tried particularly, but his knowledge may be of service to the jury, or the court, or to both, to enable them to come to a correct conclusion as to the case which is being tried. He is, for instance, a physician, whose whole life has been devoted to study, and the knowledge which he has ac-

quired is his stock in trade, and it is the veritable capital by which he gains a livelihood. If a man's wife is sick and the attending physician is at a loss as to the diagnosis of the case, and our expert physician is called in to give his opinion upon the case, no one thinks of his doing this for nothing, but he is paid a suitable fee as a matter of course; but if he should be called by a party to a suit at law to give the very same information, the judge very likely would decide that he was entitled to no fee at all, as the few shillings allowed common witnesses could not be called a fee in a professional sense of the word. Some physicians have very properly refused to give up their capital to every scalawag who sees fit to ask them for it without some compensation, and have been sent to jail for contempt of court. Now a party to a suit at law either has a right to the services of expert witnesses or he has not. If he has a right to their services once he has a right to them again, and if it is a matter of right and law, then if his business is so extended that he needs his expert witness all the time, he can command such services all the time, and if he is not served willingly he can have the expert witness punished for his contumacy by incarceration in the common jail until he will comply with his desires. And we have had decisions in the courts sustaining such a doctrine as this! The fact is the whole practice in regard to expert witnesses is simply ridiculous. Each party to a legal contest is allowed to bring upon the stand expert witnesses, and these are expected by the two parties to sustain their *own* side as far as possible by their testimony. The consequence is that experts are as a rule made up of those who will swear what is necessary for the success of their side of the controversy and nothing can present a more disgusting spectacle in a court of justice than to see two sets of *expert doctors* contradicting each other in the interest of those whose suits they are expected to maintain. If there is any necessity for expert testimony in a case, let the judge be empowered to call in some disinterested and competent expert, question him himself for the enlightenment of himself and the jury, and see to it that he is paid a reasonable amount for his services and let these disgraceful and disgusting scenes which are so common in courts of justice cease.

The *Western Lancet* reaches us from the Pacific coast. It has

recently changed hands and has suddenly grown from a somewhat diminutive journal of twenty-four pages to a respectable looking monthly of forty-eight pages. It is now edited by some of the professors of the University of California. We are by no means sure that the latter commendation will really commend it to the favorable consideration of our readers, for we are obliged to confess that we have seen many communications from those who were known as professors, which would not do much credit to a school-boy of a dozen years, who too often seems to endeavor to gather together as many high sounding words as possible in each sentence without any regard to their significance.

The *Cosmos* for March gives us a paper which was read by Dr. J. Smith Dodge before the Odontological Society of New York, upon filling teeth with soft foil, which is plain, full and sensible, and will repay any one who reads it for their trouble. Transactions of various societies, which present for the most part a great similarity to each other and a constant recurrence of the same doctrines and ideas, and consequently become monotonous, nearly fill up the rest of the number.

The March number of the *American Journal* has finally published Dr. Waterman's article upon Anæsthetics, which we commented rather freely upon some two or three months since in our "Journaliistic." The article is of much interest, and may be of much service to those who are capable of doing their own reasoning and making legitimate deductions from the facts presented, but accepted with the deductions of the author, its influence in practice would be to substitute more dangerous agents for nitrous oxide gas, which all the experience of the past has shown to be our least dangerous anæsthetic.

FIVE FALSE TEETH AND CELLULOID PLATE IMPACTED IN THE ŒSOPHAGUS FOR FOUR MONTHS—SUCCESSFULLY REMOVED.

BY A. B. COOK, A. M., M. D.

The following is a brief history of this unique and interesting case: L. F. Heidelberg, of Paulding, Jasper county, Mississippi; age twenty-five; occupation, a dentist; weight at time of swallowing the teeth 160 pounds; health good. May 13, 1877, about three o'clock, at night, during sleep, he swallowed a celluloid plate containing five artificial teeth; dimensions, long diameter, one and a quarter inches, transverse diameter one inch, width of the five teeth one and a half inches. When he awoke he found the teeth and plate had passed into the pharynx, from which he made strenuous efforts to dislodge them, but failed. The plate and teeth passed through the natural constriction at the junction of the pharynx and œsophagus; passed down and lodged at the second natural constriction, where the œsophagus passes through the diaphragm to connect with the cardiac orifice of the stomach, where I found them on passing the stomach-tube when he presented himself for treatment.

For five days after the accident he suffered much pain; had bloody expectoration and great difficulty in swallowing fluids. Opiates were given to allay pain, but no attempt was made with instruments to remove the plate and teeth. In fact some doubted whether the teeth were in the œsophagus, as many sincere non-medical persons have scouted at the report of the teeth ever having been removed, regarding the whole story as a professional hoax, and placing it in the same category with the Tennessee snake romances. From the time of the accident, May 13, he suffered constant pain and uneasiness, always greatly increased by every attempt to swallow; his sleep was often broken by exacerbations of pain. When asked to locate the pain, he said the greatest pain was experienced at a point behind the sternum, a little to the left of the median line, corres

ponding to the fifth costal cartilage, which indicated where the teeth had lodged and become impacted in the œsophagus. He could only swallow fluids, and frequently these with great difficulty; he could sometimes swallow small particles of solids by chewing them very fine and drinking water, tea or coffee immediately; often several minutes would elapse before the column of fluid would, by its gravity, dilate the stricture sufficiently to let the food pass; this I witnessed several times before I removed the plate and attached teeth. On two occasions the instrument brought up small particles of bread which could not pass the stricture, although he had eaten two or three hours beforehand, and had also filled the swallow with some fluid, as was his custom to effect dilatation of the stricture. The difficulty of swallowing was gradually increasing, and death from closure of the œsophagus was only a question of time.

SEPTEMBER 6, 1877.—Mr. Heidelberg came to Louisville to consult me about his unfortunate condition. He had the appearance of one who had endured much physical pain and mental anxiety. I passed the stomach-tube and bristle-probang eleven inches; could detect a foreign body, but could not pass the instruments through the stricture; the second time I passed the bristle-probang I could distinctly feel it catch the teeth, but it slipped, the end of the instrument having only passed partially through the stricture.

SEPTEMBER 7TH.—I used the probang and small flexible wire with silk thread-loops attached, but neither instrument would pass the stricture, on account of the irritability of the œsophagus. The presence of the instruments caused much retching and attempts at emesis, but no fluids could be ejected from the stomach; the instruments brought up bloody mucus and portions of food that had not passed the stricture.

SEPTEMBER 8TH.—I succeeded in passing the bristle-probang through the stricture into the stomach; I then expanded the bristles, withdrew it and succeeded in catching the plate and teeth, and by a steady, firm pull dislodged them from the point of impaction in the œsophagus. When the plate reached the junction of the œsophagus with the pharynx it required another firm draw to bring all into the pharynx, from which they were removed with the fingers and forceps. When the patient gazed

upon that piece of his own handiwork, which he had not seen but felt for four months, his expression of joy can be more readily imagined than described. After the removal of the teeth he could swallow fluids without difficulty. I ordered a fluid diet for at least two weeks.

September 9th.—Reports that he slept well; has no pain; feels a little soreness in the pharynx, the result of the manipulations of yesterday.

September 13th.—He feels well; has no pain; swallows without difficulty; has gained one pound daily in weight, having lost twenty-nine pounds, while he carried his teeth in the gullet. Discharged. He informed me the latter part of November that he was well and actively engaged in business.—*American Medical Bi-Weekly.*

A FRACTURED MOLAR.—ITS TREATMENT.

BY JOHN S. SMITH, D. D. S., COLUMBIA, PA.

Mr. H., a merchant, aged about forty-five years, of good health, presented in October, 1877, suffering from a fracture of the right superior second molar, desiring its removal. Upon examination we found the tooth dead, having a longitudinal fracture extending from the mesial to the distal side, and upward and along the lingual fang about a line and a half in length under the gum and process, with a large amalgam stopping occupying the center of crown, holding the fractured portion in a loose condition to the buccal portion of tooth, thus causing much irritation to the gum and membrane. The lingual portion of gum much swollen and tumified, threatening to envolve the entire surrounding periosteum. The occluding tooth being in place in the lower jaw, we concluded to save what yet remained

of the molar, if possible, and accordingly adopted the following

TREATMENT:

The stopping was at once removed, together with the fragment of broken tooth, dressing up the rough margins of walls with fine burs and burnishing. The sharp edge of process, along the fractured fang, was smoothed down, and the gum excised, with a view of getting it out of the way, and also depleting the vessels, thus checking inflammatory tendencies of the root membrane. The pulp chamber was laid open, and the dead pulp removed, together with the debris in root canals. The chamber and canals were now thoroughly washed with tepid water, dried and dressed with alcohol 90 per cent., and a stopping of sandarac and cotton placed in the cavity. Acidum tannicum was now applied as a dressing for the gums, and the following wash ordered to be used for a few days:

℞. Acidum Tannicum.....℥j.
Sodæ Boras.....℥j.
Mel. Despumatum.....℥ss.
To be added. Sage Tea. s. q. to make.....Oj.
M. Use every hour until parts regain their normal condition.

Patient returned in a few days, the inflammatory condition having entirely subsided. The root canals were then thoroughly cleansed and dried, and filled with a thick solution of gum sandarac, the upper third with ox. chlo. of zinc. The lost portion of lingual fang restored by packing a thin film of gutta percha next to the alveolar process and soft tissues, starting the metal filling* upon the root at the junction of fracture, building downward and across the crown to retaining pits made in the buccal portion of crown. The work was afterwards well polished. No further trouble ensued, and the case bids fair to be a success.

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* Sterling amalgam was the metal used for the present, with the view of refilling with gold.

Proceedings of Dental Societies.

TRANSACTIONS OF THE AMERICAN DENTAL ASSOCIATION.

Immediately following Dr. Dean's report, we notice a volunteer essay by Dr. L. C. Ingersoll, of Iowa. The doctrine put forth in this paper is in sharp contrast with that advanced by Dr. Dean. The question discussed and answered by Dr. Ingersoll, in this paper, is given as follows: "*Is the dental pulp essential to the integrity of the tooth structure or the continuance of the teeth in the mouth till old age?*"

The doctor treats the subject from a therapeutical as well as a physiological standpoint, and in summing up comes to the conclusion that the dental pulp is *not* "essential to the integrity of the tooth structure or the continuance of the teeth in the mouth till old age."

He refers to the special and almost universal attention which has been paid to the preservation of the pulp. "It has been made the acme of professional skill, the criterion of professional study, and in our enthusiasm it has been pronounced a crime to extirpate the living pulp of a tooth." He calls attention to the confidence which the profession seems to have in the treatment of exposed pulps with oxychloride of zinc, as shown in the reported successful cases. He says "if there is no lingering doubts in these *reported cases* then the evidence is overwhelming, and to esteem a pulp in any condition of its life of little importance is being false to nature, and to extirpate a living pulp is most flagrant injustice." In glancing at the value of these reported cases as ordinarily given to us in society meetings and in the journals, to his mind they do not bear the marks of reliability. He puts those making these reports on the witness stand and questions them as follows:

Your cases are reported as representing a well marked and definite condition which you call exposure of the pulp, and your treatment of the cases is fixed and definite, viz., the use of crea-

sote and oxychloride of zinc, and your success is defined simply by the word success. Now, sirs, allow me to ask, what do you mean by exposure? Do you regard alike the opening as broad as the diameter of the pulp chamber and the opening as small as a pin-hole? And do you call that an exposure where the only opening is through the emptied tubes of the dentine, and only microscopic? Do you call that exposure which is made by excavating over a healthy pulp and that which is produced by the progress of decay, one and the same thing as regards treatment? And do you employ the one covering or capping material for all these different stages of approach to the pulp chamber, placing your cap directly upon the exposed face of the pulp, or upon the intervening dentine, as the case may be? And the pulp—is the condition of it always the same whether the exposure is great or small? Is the condition of it always the same whether caused by an excavator suddenly, or by the slow progress of decay? The treatment—is that the same, whether the exposure has been of brief or long continuance—with creasote and oxychloride? Does every condition, whether it be irritation, determination of blood, congestion, or suppuration, succumb alike to your *one* treatment—the creasote bath and oxychloride? Do you know that the pulp will remain in a healthy state with an artificial covering—done up in a rag like a sore finger, or like the sore finger that it will *re*-form under the rag its own natural covering? Are you sure that secondary dentine will be formed after the peripheral cells have been obliterated as a result of the exposure? How long after the first indication of exposure can the pulp be treated with success? And what do you call success—the comfortable condition of the tooth for one month, for six months, one year, three years, or till old age? What are your tests of success? Is there no deception in cold water, ice, percussion and the drill? Are your patients so versed in pathological sensations as to report to you understandingly and without self-deception the twinges of experience that may follow the treatment of their teeth?

He thinks our efforts to save the dental pulp from death by disease most commendable, and our only fault seems to be in believing too confidently that we do it.. "Some in our profession, by a cautious and guarded selection of cases, have been success-

ful in a majority of cases, and, as a general rule, the majority of cases are failures within a period of eighteen months to three years." The arguments which the Doctor brings forward in support of his theory will be found in the following extract:

Probably a fair statement of the case as concerns the treatment of the dental pulp by all classes of practitioners is this: A large number of the cases called exposure of the pulp are cases of irritation caused by thermal changes or osmosis of oral fluids, without having caused inflammation of the pulp. In such condition the base of the cavity is extremely sensitive to the touch of an instrument, because of the thinness and elasticity of the plate of dentine still covering it—is sensitive also to cold water and to air. Another class which have been called cases of exposure of the pulp were cases of simple inflammation, and were readily relieved and the pulp restored to its normal action, by giving relief from such causes of irritation as I have named above. Another class of cases treated are those cases of real exposure caused by violence in mastication or by the work preparatory to filling, and brought under treatment without delay. There is no doubt that the three classes of cases named have been treated with the oxychloride capping with complete and permanent success. If only such cases as these were presented to us, cases that could be with a good degree of certainty known to be such as I have named, we could by careful manipulation, employing not only oxychloride of zinc, but any other material which has been proved by experimental tests to answer the conditions, no doubt reach a high average of success. But the pathological nomenclature of these reported cases covers with a single term all cases of exposure—the worst forms of exposure and those of long standing; and includes those cases where the pulp is undergoing the process of elementary destruction. In nearly every such case I believe that the oxychloride treatment only helps the pulp to die easy, and embalms it for a season after death.

I come now to the direct question—Is the dental pulp so essential to the integrity of the tooth structure when matured, and is the treatment of it in all diseased conditions so simple and uniformly successful that deliberate extirpation is an unwarrantable practice? And, furthermore, does the continuance

of the teeth in the mouth, comfortably and usefully, depend largely upon the functional support of a living pulp? To this double question, and to each of its parts I answer, no. I have already given my reasons for doubting the reported success of treatment based upon a high estimate of the intrinsic value of the pulp.

Let us now turn our attention to the integrity of the tooth structure as affected by the presence of the pulp. It has been stated and believed by many that vitality in the teeth protects them from decay. The analogy of inanimate nature and of the soft animal tissues is adduced in proof. It is well known that if the vitality of any portion of soft tissue terminates, the substance rapidly decomposes. But the law does not hold good concerning the hard tissues. When the English king, Edward III, died, a few weeks, or months at most, were sufficient to decompose all the devitalized soft tissues of his body. But the devitalized hard tissue of his teeth retained its integrity for more than three hundred years, when his remains were exhumed. If vitality is essential to protect the teeth from decay, the enamel, which is the most exposed and must first fall a prey to the wasting influence of decay, would, in the wise economy of nature, have been more vitally supported. Vitality in children's teeth has a wider area, and more formative and reparative energy than in adults' teeth, yet they decay more rapidly. Such facts are sufficient at least to create doubt, and a necessity for strong proof. Whatever foundation there may be for this theory, it probably has its strongest point in a single fact, viz.: When the progress of decay has been arrested by any accidental condition or applied remedy, by a vital process, the dental fibrils are calcified, and thereby the body of the tooth made more dense and better able to resist the influences producing decay.

The chief office of the pulp among the dental tissues, is that of being the formative organ of the dentine. To this work it gives up its life. In the performance of this function it gradually exterminates itself. Thus by a law of its own it *tends to self-extinction*. In advanced life, teeth are found with the pulp chamber and the root canals so wholly obliterated as to afford only the narrowest space as the grave of their former occupant.

All that remains is the shriveled skin of the extinct pulp; and the walls crowd hard upon it. In studying the high importance of the dental pulp, bear in mind this tendency to diminution and self-obliteration. Having completed its formative work, the indications of nature are, that the pulp has little more to do. In this view of the case the decisive question to settle is, at what period in life can it be said to have completed its work? When do its legitimate functions terminate, so that it becomes of little consequence whether it lives or dies?

There is a period of growth and development, and a period, no doubt, of maturity—when the human body stands complete in all its form and functions. The precise time when this period arrives, dating from conception or birth, will vary by months and years with different persons. It is assumed as a common average that from eighteen to twenty-one years are required to give physical completeness to the human body—the female maturing in less time than the male. Whether the time generally conceded be strictly correct or not, it is not material for us, in the present discussion to pass judgment. So much of the formative work of the teeth is carried on before they emerge from the gum, that I think we may safely say that they become thoroughly mature for their functional work in ten years after their emergence—counting the same number of years for each tooth after the time of its emergence. I will quarrel with no one as to the absolute correctness of this estimate. The number of years required in any case will be estimated by the ability of the organ for the complete performance of function. The pulp at this period takes its rest. The enamel organ exhausted itself at an earlier period, and became extinct. The fact that enamel matures in hardness and brillancy after the tooth has cut the gum, is, to my mind, no evidence of any remaining vitality in the sheaths that possibly may form the microscopic bond of union, laterally, of the enamel rods. The lime salts composing the enamel have such an affinity for the elements that load the atmosphere, that this cause alone is abundant explanation of the crystalline beauty which the enamel assumes after emergence from the gum.

If this view of the case, as concerns the waning functions of the pulp, seems unphilosophical—contrary to nature—I have but

to refer you to the generative organs, that cease their function and take their long rest after the meridian of life; to the same organs also that *exist* in organic completeness, but never perform function through the entire period from puberty to meridian.

If I have rightly set forth the office work of the dental pulp and its relations to the other dental tissues, the profession have overestimated the importance of the organ in *mature teeth*, and have complicated their case with more unmanageable disease of other tissues by too long continued efforts, in bad cases of exposure, to save the vitality of the pulp. The high standard of practice at present, requires me to conduct my diagnosis and decide upon the treatment of nearly every case with reference to saving the pulp alive, even to the preservation of of remaining fragments of nerve in the root canals—to make even the worst cases a subject of continued experiment, and to be reconciled to death of the pulp only after, and as a result of, the failure of doubtful experiment—and this, because of its *intrinsic value to the hard structure.*

Viewing the case from the standpoint I have presented, *extirpation* comes earlier into the arena to compete with the well received practice of pulp preservation. And now, in the language of the law, there is a "change of venue," and a new issue, too. The question is no longer the preservation of the pulp, but the preservation of the tooth, and oxychloride treatment of the pulp as opposed to extirpation as a means of preserving the tooth in a comfortable and useful condition to old age.

Setting aside those cases of exposure where there is no established disease of the functions or structure of the pulp, as cases readily yielding to the "capping" treatment, all other cases come to us burdened with too formidable an array of doubts, to warrant the dentist in tampering long and risking much by pulp treatment, when so little is risked by pulp extirpation.

It is a well established fact that there are in the human organism, generally distributed, functional powers working at varying balance of each other for waste and supply of tissue—that worn-out tissue is being perpetually removed and new pabulum supplied to rebuild the waste. I believe it will be found that the teeth, that are an exceptional tissue in so many other particulars, are also exceptional in this. It is quite evident to my

mind that the *enamel* is *not* subject to this law of waste and supply, and it is by no means an established fact that the *dentine* is subject to the law, except as pertains to its animal portion, which in a matured tooth is a very small proportion of its substance. The argument, therefore, for the preservation of the pulp, based upon its supposed value in replacement of lost tissue of the dentine, has too uncertain a foundation to carry conviction to the mind. Yet this is the strongest argument and the only one worthy of consideration that has been advanced for the preservation of the pulp. But after the pulp is dead, there can be no loss of dentinal tissue by absorption, hence no demand for replacement. The argument for the value of the dental pulp in calcifying the dental fibrils after the maturing of the tooth structure, as explained in the former part of this paper, I have already inferentially answered.

The success of pulp extirpation consists in the *thoroughness* of the operation. The effort should be to remove every vestige of the devitalized tissue, even from the termini of the root canals. Should this for any cause be an impossibility, what remains should be dried of its watery portion, shriveled and embalmed. This cannot be done in a day; it takes time. Thorough work in extirpation requires very great patience and very skillful manipulation. Not what we may *wish* to do in conducting the operation of extirpation, but what we *can* do, is the dictate of sound judgment.

Therapeutical treatment is based upon our conception, not of physical forms but of the activities inhering in those forms and our estimate of their value to the organism. If in our therapeutics we have been led somewhat astray—though on the right side, yet *astray*—by overestimating the importance of the organ we have attempted to treat, and have often failed, we need not "mourn as they who have no hope," for there is hope still *for the tooth* in *extirpation* of the pulp. The cases of longevity and even of extreme age of pulpless teeth are so numerous that I need but to allude to the fact to stimulate your memories to recall them.

Henceforth let our watchword be THE SALVATION OF THE TEETH, not the salvation of the pulp.

ST. LOUIS DENTAL SOCIETY.

OFFICE OF DR. A. H. FULLER,
ST. LOUIS, April 2, 1878.

DR. FULLER related a case of a lady who called to consult him about a sore on her gums over the right superior central incisor. She said she had noticed an inflamed condition of the gums at that point some eight or ten days before, but for three or four days did not give herself any uneasiness about it, thinking she must have bruised the gums in some manner by a thorough use of the toothbrush. Finding that it did not get well or any better, as she could see, she called upon "her dentist," who told her that the sore didn't amount to anything, and would be all right in a few days. He however touched it with tincture of iodine. The iodine did not cure up the sore, and after waiting for four or five days she decided to see some one else about it. Finding that her family physician was out of the city, she called upon a medical acquaintance and asked his opinion. He thought the iodine had irritated rather than helped to cure the sore, and that the gums, if left alone, would get well without any treatment in a few days. She had let the sore alone for two or three days, but it was getting worse instead of better, and she had called to see what I thought of it. The patient had always been very healthy and with the exception mentioned was at the time in apparent perfect health. The teeth showed the best of attention so far as cleanliness was concerned, there being no deposit of tartar in any place and the gums in all localities in a perfectly healthy condition. She had never to her knowledge had a blow upon the teeth or gums, nor could she account for the sore in any manner. She said that for the first few days the tooth had been sore to the touch and had seemed to be longer than usual, she striking it with the occluding teeth occasionally, but this she had not noticed for the past two or three days. I found upon examination an angry looking sore at the point indicated about the size of a half-dime, extending more towards the lateral. I also noticed considerable swelling of the submax-

illary glands of the right side just anterior to the ramus of the jaw, and upon passing a thin narrow-bladed instrument under the gum was confident that there was necrosis of the margin of the alveolar process. From the appearance of the ulcer I was forced to believe that it was a primary syphilitic sore. I informed the patient that the case required other than local treatment, and that I would see her physician and tell him what I thought about the matter. I syringed the sore with warm castile soap water, slightly touched the margins with nitrate of silver, and then with one of Rumbold's spray producers thoroughly applied, as warm as could be borne, vaseline and carbolic acid (two and one-half grains carbolic acid to the ounce of vaseline); after this placed a pledget of cotton saturated with vaseline over the sore to keep it from being irritated by the lip, and this treatment was continued with occasionally using aromatic sulphuric acid, and the result was the healing of the ulcer without any sensible secession of the gum. I will add that her physician was at first inclined to disagree with me in my conclusions, although he could not account for the appearance, but from personal acquaintance and the social position of the patient, he was led to believe it originated from some other cause. Upon the appearance of secondary symptoms, which placed the case beyond doubt, he commenced the regular course of treatment for this disease. From the first I cautioned the patient against kissing any one. I was of the opinion at the start that I had rather an uncommon case on my hands, but from the number of old women and lady friends of the patient who had been at some time in their lives troubled exactly the same way, and each with a remedy which would certainly cure in a day or two, I was forced to believe that they were possibly misstaken or that I was a novice.

ON THE ELECTRO-CHEMICAL ACTION OF METALLIC SUBSTANCES UPON THE TEETH.

BY W. KENCELY BRIDGMAN, L. D. S.

MR. PRESIDENT AND GENTLEMEN :

The peculiar effects produced by the metals and metallic compounds which are applied to the teeth *in situ*, is a subject which has occupied a very considerable portion of the writer's attention for many year's past. But it was not until the idea occurred of decay being an electro-chemical effect, that any clue was obtained to a solution of the question. While investigating the action of voltaic electricity upon organic compounds, it was discovered that all the defects of metallic fillings in the teeth could be represented by results obtained out of the mouth, and in fig. 1, plate 2, of the essay, as published in the Transactions of this Society for 1863, page 391, is given a first example of this occurrence. Since then, however, the whole subject has undergone a close investigation, and been worked out to a most satisfactory conclusion, and almost every day now produces examples which tend to confirm the correctness of the theory advanced for the first time in that essay.

That decay might be, and probably was a chemical action, every one was quite ready to admit, and, in fact, such was the general belief; but how it could be electro-chemical, did not appear to be in the slightest degree comprehended. The immediate effects of chemical action could easily be recognized as such; but the previous electric condition, *giving rise* to this chemical action, required a somewhat intimate acquaintance with the laws of the physical forces to render its presence appreciable, and consequently the only valuable portion of the theory has hitherto been left in abeyance.

To render the latter portion of the subject intelligible, and to show the precise nature of the action which takes place when metallic substances are brought into contact with the teeth, is the object of the present paper. And in order to explain how the

voltaic condition is engendered, it has been deemed expedient to extract from a paper "On the Theory of the Voltaic Pile," by the author, published in the *Philosophical Magazine* for November, 1869, the following passages, as constituting the groundwork of our our present inquiry: "In conducting the experimental researches relating to the action of the battery, Faraday starts with the assumption that 'when an amalgamated zinc plate is dipped into dilute sulphuric acid, the force of chemical affinity exerted between the metal and the fluid is not sufficiently powerful to cause sensible action at the surfaces in contact and occasion the decomposition of water by the oxidation of the metal." And again: "A battery constructed with amalgamated zinc, and charged with dilute sulphuric acid, is active only when the electrodes are connected and ceases to act or be acted upon by the acid the instant the communication is broken.' The very decided manner in which the assertion that no chemical action takes place between the zinc and the acid, unless the dissimilar metals of the battery be put into communication is made, and the frequency with which the belief in it is reiterated in various forms, make it appear that this supposed fact was considered to be of some importance in connection with the conclusions arrived at. If, however, it be put to the test of examination, it will be found to receive a direct negative from experimental evidence, and shown to be altogether a fallacy. A rod of absolutely pure zinc, three and one-fourth inches long, after being thoroughly amalgamated with fresh distilled mercury, and drained, and weighing 487 grains, was placed half its length in cold dilute sulphuric acid, and the other half exposed to the atmosphere, in the same position as the ordinary plates of a battery. In a very short time bubbles of hydrogen made their appearance over the whole surface exposed to the acid, and after forty-eight hours the metal was found to have lost upwards of two grains in weight. This loss, however, was by far the least important part of the results obtained. The immersed portion of the metal had not been acted upon uniformly over its entire surface, but the action had been greater at the surface of the liquid. At the same time the exposed portions had become covered with patches of crystalline sulphate of zinc, high and dry upon the projecting portion of the metal. Therefore, not only had chemical action been ex-

erted between the metal and the acid and the water decomposed, but there was the additional evidence that the metal itself had been polarized. In order to render the effect more apparent, the experiment was repeated with copper instead of amalgamated zinc, as the color of the crystals and the coloring of the acid afford more conspicuous evidence of the results which are being produced.

A piece of stout copper wire was then similarly placed in acid; the latter very soon gave signs, by the coloring it received, of the copper commencing to undergo solution; and after having been suffered to remain undisturbed for twenty days it presented the appeaaance shown in the diagram,* Fig. I. The portion A, which had been immersed in the acid, was partially corroded into pits and furrows, gradually decreasing in extent downwards. The upper portion B, exposed to the atmosphere, had become coated with a layer of minute and beautiful crystals of sulphate of copper, extending from near the top down to within three-sixteenths of an inch of the liquid. At the intermediate portion, C, a greater amount of chemical action had been induced—corroding the wire, as represented, about half way through, and forming a neck tapering upwards. That the action which arises between the metal and the acid is due to polarization is evidenced by the following proceeding: "A similar piece of copper wire, wholly submerged in the acid, so as entirely to exclude any portion of the metal from coming into contact with the air, has remained for many months without imparting the slightest tinge of color to the liquid; but on suffering the fluid to evaporate, so as to bring the upper end of the metal near to its surface, the instant the slightest portion becomes exposed to the atmosphere chemical action immediately commences." There is, thus, where no sufficient normal affinity exists between the metal and the liquid to effect the decomposition of water, a power imparted by the metal being polarized by the atmosphere, which renders it then capable of accomplishing it.

The atmosphere in its normal state is electro-positive, and by

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* The diagram referred to in this paper will accompany the "Prize Essay" in the next issue.

a well-known law of induction, it renders certain bodies opposed to it electro-negative. The exposed end of the copper is, therefore, thus rendered electro-negative, and the acid by the same rule being electro-negative also, the immersed end of the metal becomes electro-positive. It is an established rule that bodies to be electro-decomposed must first be rendered electro-positive, and it is also part of the same rule, that bodies receiving an addition of matter must first be made electro-negative. Hence, the exposed end of the metal has become negative, and received the crystallization, while the immersed portion being positive, has been acted upon accordingly. The appearance, however, of the crystallization upon what was at first the dry end of the metal requires particular attention. It is one of the special effects of electrolytic action that fluids pass to and accumulate at the negative pole. Obeying this law, the acid immediately begins to ascend and spread itself over the surface of the unimmersed end of the metal.

But now we have another special provision which demands the most careful and attentive consideration, as it constitutes the first active step in the resulting chemical action. One metal placed in two dissimilar fluids, as the air and the acid, acquires the same condition that two dissimilar metals, or one metal non-homogeneous, assume when exposed to the air; each has become polarized, and rendered amenable to chemical action. Water being a compound of gases chemically combined can have its gases uncombined only by an equal degree of force being made antagonistic to them; and consequently the decomposition of water must be preceded by some other arrangement. Now, the atmosphere being only a mixture of gases, or gases merely in a state of mechanical admixture, which admits of their being readily separated on the slightest interference, supplies the initiatory step by which this decomposition can be effected.

The first immediate effect upon a polarized metal is to drive the oxygen of the atmosphere to the positive end. Its combination with the metal, in oxidizing or rusting it, is a chemical action determined by its electro-polar condition; and it has been established by Faraday and others that this chemical union is invariably accompanied by a development of electricity, which in its turn can be made to produce electro-chemical results of an

equal degree in another direction. The greater amount of action taking place at the neck, C, of the copper wire will now be readily comprehended. The oxygen of the atmosphere has been driven toward the positive end of the metal; but its progress has been arrested by the acid surrounding it. The thin film, however, rising from its surface being soon saturated with the oxygen, and presenting the latter in its most favorable form for acting upon metal, facilitates its oxidation, and consequently accelerates its solution, and renders the ascending acid saturated and ready for at once becoming a crystaline deposit, while little or no solution has been effected in the liquid below.

It must be kept in mind that an electric state is not a fixity, but is relative, and depending upon attendant circumstances. Thus, if the copper wire, as shown in the diagram, had been subsequently inverted, the immersed end, which is now positive, would then have been rendered negative, and *vice versa*; or had the acid at any time been filled up to the top of the tube, the exposed portion only, however small that might be, would have remained negative, the surface of the liquid determining the line of demarkation between them.

Let us now apply these facts to the mouth. The external epithelial layer of the gum is constantly throwing off its worn-out cells, and by this wasting process it determines its electro-*positive* state, while the crown of the tooth, as a continuation of the epidermal layer, partakes of the like condition. Were the teeth wholly and constantly submerged, and protected from the air, it is probable that, like the copper wire beneath the acid, they, too, might remain intact. But as the air is constantly passing into the mouth, or even through it in the act of breathing, they are thus, having one end exposed to the air and the other to the fluid moistening the gum, subject to the same polarizing influence as the metals. The negative portion of the polarized tooth being represented by the portion B in the diagram, it will at once be comprehended why tartar accumulates upon certain parts only of the teeth, and how it is enabled to creep over the surface and adhere with such tenacity. The principal amount of electro-chemical action has been shown to take place at or near the surface of the fluid, as represented at C, the latter determining the line of demarkation between them.

Hence, in the mouth this line may be taken as existing at the free edge of the gums. The moisture accumulating here, in the event of any electro-chemical action taking place, would necessarily be immediately above that line, and consequently the substance of the tooth directly above the gum would be attacked. We see this actually taking place in the peculiar decay so common at the exterior or anterior basal area of the molars, and also on the same part of the upper incisors. In the interstitial divisions the moisture accumulates between the teeth by capillary attraction, and in connection with this we have *approximal* decay as one of the commonest forms occurring. The oxygen is attracted to the part, and produces the acid so invariably present, while by electrolysis the lime is abstracted and removed to another part, or carried away in solution. Every other phase and phenomena of decay can be as readily traced and explained by the same action; but it will be necessary now to enter into further detail on that point, as the more especial object is to demonstrate it to be the electro-chemical action which constitutes one of the chief defects of metallic stoppings.

In Fig. 1, plate 2, of the Prize Essay, it is shown that an amalgam filling in the side of a tooth having one edge near the gum generates acid at the latter point. This is due to polarization. A body of metal having its two ends or opposite sides exposed under different circumstances, becomes polar, and in proportion as there is any substance to be acted upon by the oxygen, so is the amount of chemical action regulated. Thus, a metallic plug in an approximal cavity, or in the external basal area of the molars, will have the cervical edge continually wet, while the upper part may be comparatively dry; and hence it will assume the condition represented at B and C of the diagram. It has often been lamented that however carefully and well these fillings may have been done, there is the ever-recurring annoyance of finding, in a few years at the most, and not unfrequently in a few months, that the sides of the plugs and baso-canal surface have become defective; showing that although all the defect may have been removed in the first instance, *the cause* has still been retained. With the entire range of metals and metallic compounds, it may be taken as a fact that from gold to copper and zinc, it is only a question of degree; for the

one cause affects them all more or less. In respect to this, gold is unquestionably the best by very far, as being one of the least oxidizable; but even with this, certain precautions are essential to success. The one indispensable condition is that there shall be no lodgment for moisture at any point of its circumference. The edge of the plug must be made as perfect as possible, and no fissures communicating with it may be suffered to remain; for if there be, electro-chemical action will be certain to recommence. With amalgams this precaution is, if possible, even more important; but with these there are other points requiring attention. The composition of amalgams is a subject which has never yet been systematically investigated, and those now in use differ considerably in character. Zinc and copper, and their various alloys with tin and silver, etc., form the hardest amalgams; while gold, silver, palladiums, and platinum form only imperfect amalgams, which never acquire sufficient hardness to resist friction. In the latter, too, the mercury readily oxidizes and produces discoloration, while some of the former pass very quickly from oxidation to the acidifying stage, and thus soon reproduce the electro-chemical destruction of the dentine. Of the old amalagams, copper formerly known as Sullivan's cement, is the most valuable, and, in some of its properties, no other amalgam has yet equaled it. The fact of its admitting of being repeatedly softened tends to render it more homogeneous; while the fineness of its mechanical texture and the perfection with which it receives and retains the most delicate markings, cause it to adapt itself with but little pressure to the inequalities of surface, and thus insure a more perfect filling. Its oxidation and staining the dentine is, however, a serious objection, although there are numerous instances where even this is less objectionable than the certain loss of the tooth after a short time, when almost any other amalgam is used.

There is now another and more serious objection still to be urged against some of the more modern preparations. Amalgams hardening under a state of polarization, assume, in some cases, a peculiar surface crystalization, but almost invariably possess coarser crystals. There are present two pieces of zinc which have been amalgamated and suffered to harden, one under polarization, the other without it.

With the polarized metal the surface has acquired a considerable amount of crystalization of a peculiar character, projecting above the level of its surface, together with a somewhat coarsely crystaline texture throughout; while that which has been allowed to harden without being polarized is much finer in texture, although distinctly crystaline. The two pieces of amalgam treated in a similar manner showed the same corresponding results. In addition both the polarized metals show more discoloration of substance than the unpolarized ones, and all show that amount of roughness of surface which is inconsistent with a perfect filling. With zinc this crystalization appears in its greatest degree, but it takes place to some extent in nearly all; copper, however, of the hard amalgams, showing the least.

Having thus traced the defects of metallic fillings for the teeth, the next question is whether they are inseparable, or if not, how the remedy is to be accomplished. There are two proceedings indicated as being desirable: one is to prevent polarization; the other to prevent the effects of polarization being reflected upon the dentine. The former is not by any means difficult, but it requires a thorough knowledge of the laws under which it takes place to adopt the provisions under all the different circumstances required.

Insulation, however, is one of the means to be secured. This, too, is the end to be sought in protecting the dentine. Either gutta percha, waxed tissue-paper, or allotropic sulphur, but, above all, the so-called os-stopping, forms an admirable lining for a cavity, where little success could be hoped for from an unprotected amalgam. It also compensates for the want of fineness in the texture of the metal.

A review of the whole subject leads to the conclusion that metallic amalgams are, as a rule, but little to be depended upon, unless extraordinary means be resorted to to overcome their inherent bad qualities; yet as these preparations, even in ordinary hands, are sometimes invaluable, as serving a temporary purpose, and being capable of renewal they can never be dispensed with till some better means can be found to supercede them. The silicate, miscalled oxychloride, bids fair to become a formidable rival, and in very many instances has already taken the place. The question of hardness is the material point to be gained.

There is one other point in connection with the electro-chemical action of metals upon the teeth which requires notice. Gold, which is so injurious to the enamel-covered part of the tooth, cannot be said to be as harmless where there is no enamel; wherever a gold band comes in contact with the exposed dentine of a tooth, the latter is almost invariably injured, and decays if the touched part be near the gum. The diagram will explain the reason. The gold may touch any part represented by the blue sulphate, but at C it will be fatal. Instances of this effect are very common upon the neck and posterior root of the upper molars, but which might always be avoided by proper insulation.

SEPARATING DISKS.

Arthur's disks have now been in use for several years and every practitioner of any note has given them a trial, and nearly if not all have been forced to concede that the corundum disk will not do to make delicate, thin separations, such as are desirable in many locations. These disks, however, are more efficient so far as their cutting qualities are concerned, than any other yet made, but when made thin enough to make delicate separations, are so friable that they are practically useless for this purpose. When, however, wider ones are admissible, they prove themselves very valuable. The hard rubber and corundum disks, as made by Dr. Harper and sold by A. M. Leslie & Co., of St. Louis, are valuable for thin as well as wide separations. They leave a much better surface than the corundum disk, and if handled with proper care will last for a long time if used only for making the separations, and if one does not use the *side* instead of the *edge* of the disk. If the side of the disk is used the central part is soon broken out of the thin ones, but the thicker ones may be used either upon the edge or side for a long time. I have used a single one for several months nearly every day, and it was then broken by accident, being very little worn.

Dr. Babcock's diamond disks were made first I believe by pressing diamond dust into the sides of a copper disk, but I think nickel is now used instead of copper. The sides of these disks cut very well, indeed, and leave an exceedingly fine surface upon the tooth. I have been able also to make fine separations with them, but as the diamond dust does not permeate the metal the cutting is necessarily confined mostly to the sides so that separations are made with some difficulty. They are valuable in dressing up proximal fillings, and indeed in many operations. Wheels of various sizes are also made in the same way which act admirably in cutting down and finishing crown fillings, leaving a surface which admits of very little improvement by polishing. If the diamond dust be finally worn off they can be recharged without much expense. Although these disks are somewhat expensive, one who has been accustomed to use them would not like to do without them. J.

AMERICAN DIPLOMAS IN CANADA.

It is well known to the readers of our dental journals, that much dissatisfaction has been felt by the American dental colleges on account of the rejection by the Examining Board of the Royal College of Dental Surgeons of Canada, of the graduates of these schools. But comparatively few American graduates have been admitted to practice by this board.

We have been at a loss for a reason for this seeming partiality on the part of our Canadian brothers. If we institute a comparison between the profession of the States and Canada in point of ability as operators, we certainly do not find it unfavorable to American dentists, and we feel that no one, at all capable of judging of the status of the profession in the States and Canada, at the present time or even in times past, will give Canadian dentists the lead, either as scientific thinkers or operators. Neither is our ethical code far behind theirs. What then can be the cause for thus ignoring our diplomas? Are our graduates who venture across the line such a set of scalawags as

to be unworthy of recognition by that honorable body—the Royal College of Dental Surgeons? or have some of our colleges been guilty of conferring honors unworthily upon applicants from Her Majesty's domain? If so, let such institutions be censured, but do not let condemnation fall upon those who keep their escutcheon unsullied.

We almost incline to the opinion that our Canadian brothers do not care to admit American dentists into competition with them. We are aware that such an opinion does not look like putting a very charitable construction on the acts of the "board," but what other reason can be given for their behavior towards our graduates as a class?

There should be no distinction made in favor of the graduates of one section of this country over another. Our colleges should be so organized and conducted that their diplomas should command respect alike in all parts of the country, not excepting Her Majesty's domains.

We have been led to make the above criticism by an article bearing on this subject which appeared in the *Evening Recorder*, Brockville, Canada, March 15th. E.

MISSOURI STATE DENTAL ASSOCIATION.

The Missouri State Dental Association will meet for its Fourteenth Annual Session, at Sweet Springs, Saline Co., Mo. The Springs are located one mile from Brownsville, a station on the Sedalia and Lexington Branch R. R. By invitation the Association will be entertained during its session by the Sweet Springs Company free. Come one, come all, and let us have a good representation of the dentists of Missouri at this meeting.

DR. McKELLOPS.

To the many friends of Dr. McBellops, whose illness was noticed in our last issue, we are happy to say he is convalescing, and we hope soon will ba able to resume his practice. E.

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THE PRIZE ESSAY ON THE PATHOLOGY OF DENTAL CARIES.

BY MR. W. K. BRIDGMAN.

INTRODUCTION.

The part played by electricity in the organic world has long been a perplexing puzzle to the philosopher as well as to the physiologist.

Its action in the animal system is looked upon as something distinct from that force which is usually denominated "vital," although it is admitted there is much that may be considered as identical with it—so much so, indeed, that it becomes a difficult question to decide whether the one or the other prevails, or to find a line of demarkation between them. In addition to this fact, there have been so many purely electrical phenomena at different times developed from the living subject as to have given rise to various hypothetical arrangements of batteries supposed to exist in the human frame; and yet, strange to say, the one condition more than any other intimately associated with it

has been the least attended to. Chemical action and electricity are known to be so far inseparable as to render it impossible that the one shall be produced without, at the same time, the other being manifest; and it has been said by Professor Farady, that "chemical action is often a more delicate test of electricty than the galvanometer; yet with the knowledge of electricity being thus developed in animal life, it is most suprising that hitherto its electro-chemical effects in the living organism should have remained so little regarded.

It has been demonstrated also by the same Professor that "*electricity, whatever may be its source, is identical in its nature;*" and it was supposed by Dr. Wilson Philip "that the nerves which excite the muscles and effect the chemical changes of the vital functions, operate by the electric power supplied by the brain and spinal marrow, in its effects modified by the vital powers of the living animals; because he found, that while the vital powers remain, all these functions can be as well performed by voltaic electricity after the removal of the nervous influence as by that influence itself." (Note by Faraday.)*

It was announced by Professor Brande that "when liquid albumen is made part of the voltaic circuit, it presents appearances dependent upon the power used, which, when considerable, excites so much heat as to coagulate it; but with a feeble power and the poles sufficiently distant, coagulation ensues most plentifully at the negative platinum wire; a coagulum also forms at the positive wire, *where acid is sparingly evolved.*" (Manual, p. 1,138.) The preceding discovery having been made prior to the days of "electricity," its significance remained unheeded; but the manner in which the metals are acted upon, in being reproduced from their solution into the metallic state, and in any desired form, has become a fact so well-known at this time, under the above title, or "Electro-Metallurgy," as to render it a matter of less surprise that *organic* material should be dealt with in a somewhat similar way. In experimenting with a viscous solusion for a specific object, it was discovered that albumen from the egg, serum from the blood, milk, and other organic substances were not merely "coagulated," but were *disposed in a*

*Philosophical Transactions.

definite form and arrangement of parts, possessing characteristic peculiarities, in some instances resembling very closely some of those substances hitherto supposed to belong to that class usually regarded as "vital" productions.

The earthy salts, likewise, are influenced in a peculiar manner. Not only are the salts of lime taken out of their original basis of bone or dentine, and transferred to other localities and reproduced in the same or a different form of crystalization, but the acid may be separated from its base, leaving both the acid and the base either free and uncombined, or suffering both to form other combinations. "Such," says Sir Humphry Davy, "are the decomposing powers of electricity that not even insoluble compounds are capable of resisting their energy; for even, sulphate of barytes, fluor spar, etc., when moistened and placed in contact with electrified surfaces from the voltaic apparatus, are slowly acted upon, and the alkaline, earthy, or acid matter carried to the poles in the common order."

"The chemical action of voltaic electricity," says Faraday, "is characteristic of that agent, but not more characteristic tha nare the *laws* under which the bodies evolved by decomposition arrange themselves at the poles." Thus, whenever *acid* appears, it is invariably at the electro-*positive* pole, and may be taken as conclusive evidence of that condition, while the *alkaline* state evidences the eloctro-*negative*. Hence the external layers of the skin, the mucous membrane of the mouth, etc., and the dentine of the tooth, are unquestionably in an electro-positive state, and consequently are liable to the development of acidity. The source of this acidity may be either the serum of the blood or the saliva—the latter of which is so easily decomposed that I have obtained enough electricity of sufficient intensity from a battery contained in a small silver thimble, with a few drops of diluted sulphuric acid, to redden litmus paper in a few seconds when moistened with saliva.

Now, although we have occasionally an acid condition developed in certain parts, and occurring at one time more than another, these, except perhaps in such cases as the gastric juice of the stomach, etc., may be considered abnormal; the normal action being that in which the change of elements goes on so slowly and regularly that the elements of each acid or basis may

be appropriated as fast as they are liberated, and so taken up as not to be allowed sufficient time to manifest either acid or alkaline qualities.

Under these circumstances it becomes extremely easy to explain all the phenomena of *dental caries* as being produced by by *electro-chemical* action; and as this *abnormal* action can be shown to be only part and parcel of its *normal* action as developed in other parts of the system, and can be domonstrated *out of the system* from the same materials by these same means, there are strong grounds for believing in their identity of action.

There are cogent reasons also for assuming that if any great advance is to be made upon our present stock of physiological and pathological knowledge, it will have to be sought for in this direction; and when there shall be found in one individual an Owen and a Faraday, or a Huxley and a Grove, combining the profound knowledge of the physiologist with the consummate skill and tact of the electrician, *organic* matter may stand a chance of being taken to pieces and tortured to confession, with as much pertinacity as that which has already compelled inorganic matter to yield up the history of its own existence.

PATHOLOGY OF DENTAL CARIES.

1. The pathology of a subject involved in so much obscurity as the one now under consideration, occurring as it does in a substance respecting which it has never yet been definitely settled whether it has to be regarded as a vital body *possessed of vitality*, or as merely a vital product amenable only to the ordinary physical laws of inanimate nature, can only be adequately treated by first determining to which of the two conditions it has the more legitimate claim.

2. Until quite recently, the dentinal portion of the tooth has been regarded as part of the vitalized substance of the organ. Professor Bell observes: "That the teeth possess vitality; that they are connected by their organization with the general system, having nerves, blood-vessels, and absorbents, and are analogous in this respect to other bones, is a truth so strongly attested by all the phenomena they present, whether in a healthy or diseased state, that it is difficult to imagine upon wha grounds it can have been controverted, or even doubted, by any one whose opinions are deduced from observation or experi-

ment. The question is not whether in the internal cavity of a tooth, nerves and blood-vessels exist, for this is too obvious to require proof; but whether these essential components of animal organization do or do not enter into the composition of the tooth itself."

3. The existence of the dentinal tubes and the recent discovery of the dentinal occupants of the tubes (the soft fibrils of Tomes), and these being in connection with or extensions of the pulp into the substance of the dentine, might seem to give additional if not conclusive weight to the above argument; but it has been shown by Messrs. Tomes and DeMorgan* that dentine is *not* organized like other bones; " *there is no constantly recovering action* of absorption and reproduction going on in the dentine of the tooth, as has been demonstrated by these gentlemen to occur in *ordinary bone*. Besides this we must take care no longer to suffer ourselves to be misled by mixing up the *physical* with the *vital*, so as to confound the purely *vital* condition of the pulp and its fibrils with the merely physical character of the dentine—a substance which forms only an exterior coating of a compound, though strictly physical nature, *provided solely for a mechanical purpose*, and bearing the same relation to the vital pulp of the tooth that the shell does to the egg, or the rind to the orange.

4. The only apparent action of vitality that can be traced in the tooth, is in furnishing material for the subsequent depositing of new matter; but this is strictly a physical result derived from an action of vitality in the pulp, which leads to its shielding itself with a further deposit of a non vitalized protective covering.

5. The pulp being endowed with feeling, is apparently capable of receiving impressions from abroad; and this power of being irritated by external agents excites it to the exercise of its function in consolidating a zone of the tubes by means of its fibrils, so as to insulate itself from the irritant. This action clearly indicates the existence of some kind of condition rendering the proceeding desirable. To suppose it to arise from a "consciousness," is to ascribe to the pulp a degree of intelli-

*Philosophical Transactions.

gence by no means in accordance with known and acknowledged facts. To assert that the want is telegraphed to the brain and a reply is sent back from the depot at "head-quarters," is a mere hypothetical assumption based upon no traceable knowledge of facts.

6. But it is not needful to hypothecate, since it can be demonstrated by actual experiment that the production, electro-voltaically, of new matter under such circumstances is one of the inevitable consequences of the condition of the parts when and where it is formed, and that it is only the fulfilment of the laws pertaining to the electro-biology of the subject.

7. All physiologists agree in admitting the probable existence of some kind of arrangement in the animal frame answering in its effects to an electrical battery, and we have most unquestionably a portion of such an arrangement constituting the outward coverings of the system. The peripheral layers, known as the skin, consist of three distinct parts—the outermost, or epidermis, composed of a series of scale-like laminæ; constantly being formed from beneath, while the upper or external ones are simultaneously drying up and being cast off.

8. The next layer immediately beneath the epidermis, the basement membrane, a thin homogeneous, soft stratum of transparent and structureless substance, identical with the material of the epidermis, but wanting the structural arrangement which, in its turn, converts it into the latter.

9. Below the basement membrane lies the network of nerves and blood-vessels in a layer parallel with the outward surface of the cuticle.

10. It is from these blood-vessels, contained in the cutis, or true skin, that the albuminous material is obtained, and is first formed into basement membrane, and then further elaborated into the mucous layer of the cuticle. The liquor sanguinis flowing through the capillaries in a regular and constant stream, furnishes a continuous supply of fresh material, as portions become abstracted for local use; and thus the whole of the soft structures outward from the blood-vessels are continually changing through being formed and subsequently discharged.

11. But it may be asked, in what way does all this constitute it a "galvanic battery"? The answer is, that the condition and

arrangement of the several layers are incontestably those of an electro-voltaic series, while the actions performed are essentially those of a voltaic combination.

12. If a plate of zinc, and a plate of copper or silver, be dipped into an electrolyte and made to touch each other, galvanic action ensues. The zinc, or positive pole, develops acidity and is wasted in bulk, while the liquid, or electrolyte, is decomposed and its elements are carried different ways, one part to the zinc and the other to the copper; or, as is shown in the appendix when albuminous matter is acted upon, although the water and various salts it may contain will be decomposed, the albumen itself is arranged in a different form.

13. It has been asserted by Professor Faraday, that such elements as are most powerfully combined are the easiest to be decomposed; but that substances held together with a very feeble affinity, such as albuminous matter, of which all organized beings principally consist, are extremly difficult of decomposition. In this we see a beautiful provision of nature, and also a fact which tells most forcibly in favor of the belief that the electrical force developed and maintained by the *vital* arrangement is the agent employed by the all-wise Creator in moulding organic matter into the various forms and bodies required in carrying out the materialization of the living organism.

14. It has been demonstrated* that albuminous matter is not merely consolidated by the electro-voltaic force, but that it also assumes a kind of organization. The material at each pole possesses a special and distinct character, at the same time that a solid wall of structural substance grows up between them at the point where the two conditions of the force may be supposed to meet, spreading out quite across the vessel, and forming a membranous diaphragm or partition, dividing into two compartments the two portions of the electrolyte in opposite states, corresponding to the condition of the pole immersed in it. In electro-metallurgy the precipitated metal adheres to the negative pole, but with albumen it *recedes* from the pole, thus in nature preventing the negative vessels becoming clogged by a casing of their own depositing.

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*See Appendix. B.

15. This, however, is not all; the salts of lime contained in the albumen, or added to it, become arranged organically within the substance of this diaphragm, constituting it a membranous matrix, *which corresponds with and occupies the place of the under part of the basement membrane in the skin, and the dentine in the tooth.* We have thus a double result, first, the production from the liquid albumen of a solid membranous matrix, and it's then becoming tenanted by the salts of lime, converting that which was at first only a piece of tough and elastic "gristle" into a hard and stony mass.

16. In addition to this, we find the consolidated material arising on the *positive* side of the transverse matrix containing unmistakable proofs of acidity, while the negative side is neutral or alkaline.

17. Reverting now to the conditions and arrangement of the parts comprising the skin, or "Peripheral Battery" of the animal system, it may be stated, that when giving out albuminous material for new growth, the blood is invariably in an alkaline state; and therefore if the part be in an electrical condition at all—and Sir Humphry Davy came to the conclusion that all bodies in nature were in one or the other of the two electric states—it cannot be positive, and must consequently be *negative.* For the same reason that the alkaline blood-vessels must be negative, the epidermis, or the epithelium, must be positive; and, on being tested with blue litimus-paper, it will be found to be less commonly neutral than giving strong proofs of acidity. We have, lastly, the albuminous matter from the blood-vessels, in the formation of the basement membrane, spreading out laterally between the two electrodes, the cutis and the cuticle, in the form of basement membrane, precisely in the same manner as has been observed to take place artificially.

18. In tracing the correspondence still further, we shall find the several membranes of the skin answering in their actions to the electro-polar condition of an electrolyte, or matter in a state of induction between the two electrodes.*

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*It has been deemed unnecessary to make any allusion to the great central part of the battery in connection with the brain and other internal organs, as the arrangement and construction of any small portion of it explains the condition of the whole, which is but a repetition on a different

19. If a piece of metal be suspended in a solution capable of dissolving it, and through which an electric current be made to pass, one portion will be dissolved, while the portion on the opposite side will be added to by a new deposit; and should there be three or four, or more, each one will be affected in a similar manner, the wasting end or side of one being always opposed to the increasing or growing side of the next in succession.

20. In depositing metals, the new deposit forms upon or in contact with the negative plate; but with albumen, as previously stated, the solidified portion recedes from it; so that if the wire from the battery were a hollow tube, furnishing a continuous supply, it would lead to the gradual increase of the solid part forming around it, and to its being driven outward and away from the center by new layers added to its *interior*. Thus the inner side becomes the negative or growing side, while the outer, presenting itself to the positive pole, is the absorbing or acid surface.

21. Referring now to the analogous condition of the skin, the vessels of the cutis may be taken to represent the hollow negative pole giving out its continuous supply of albumen, and the basement membrane that of the consolidated substance immediately resulting from it. This, from its position, will have its *inner side negative and growing*, and consequently its *upper side positive and wasting*. The cuticle above it will also be in a corresponding condition of *increase below and waste above*. It is only in accordance with the preceding facts (19) that the wasting upper surface of the basement membrane should pass to the under or increasing surface of the cuticle; and although, microscopically considered, no two substances can be less alke, yet the chemist is able to recognize the material of the two as identical in composition, while the electrotypist has become perfectly familiar with transformations equally remarkable, occurring under the moulding influence of electricity.

22. We observe in the tooth papilla, when enclosed in its follicle and commencing to change itself into the tooth, that the new matter no longer goes to form basement *membrane*, but pro-

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scale. It is the *action* and the *electro-chemical effects* that are more particularly required to be brought under notice, for the same description of changes which are produced in one part of the battery takes place in all.

ceeds to *accumulate beneath it*, forming the *membranous matrix of the dentine*, which, so formed, then occupies the place formerly filled by the increasing portion of the basement membrane.

23. The state of the epidermis and of epithelium being electro-positive and forming part of the peripheral battery, when these substances disappear and are replaced by another form of covering, as epithelium instead of epidermis, or dentine instead of epithelium, each of these must necessarily be in a similar condition. The fact, however, readily admits of demonstration, as will be seen by experiment.

24. Dental caries has been defined as "the death and subsequent progressive decomposition of the dentine." But to accept this definition we shall have to acknowledge a "life" or "vitality" to have previously existed; for there can be no death in that which never possessed life.* It has been demonstrated that dentine can have no claim to vitality in the usual acceptation of the term; not having in itself the power of growth or of performing any other function of vitality, it can therefore be only regarded in the light of a "vital product," having an organized form and liable to the same physical changes to which other forms of organic matter have to succumb.

25. The discoloration of the dentine, which has been supposed to have arisen from its "death," is shown by the chemist to be only an ordinary form of decay, occurring under certain conditions in an organic substance; it is termed eremacausis, or slow combustion, the peculiar feature being a slow conversion of some of the elements, while the carbon remains as charcoal. The conditions under which it occurs, depending entirely upon adventitious circumstances, are purely *physical*.

26. With regard to the progressive decomposition of decay, it has been proved experimentally that under the positive pole of an electro-voltaic battery *the lime is taken out of the dentine*, and the decalcified structure is invariably *more or less acid*—in both these respects corresponding with the main features present in dental caries, and as the electrical condition which could give rise to these effects will be shown to exist, the sequence must be accepted as an inevitable and natural result of such a condition.

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*Appendix A.

The production of acidity in carious dentine has been attributed to decaying food; no bulk of food would be able to produce, under any circumstances, one-half the amount of acid often found in a small cavity; and were the production of the acid external, decaying teeth would never be coated with tartar, as will commonly be found to occur. (Fig. 1, plate 1.) A strongly acid carious cavity and tartar upon and around the necks of the teeth, together with an acid state of the gums, is a circumstance of frequent occurrence. A complete illustration of this may be seen in a specimen contained in the museum of the Odontological Society, where, in a tooth largely coated with tartar, the acid fluid running out of the carious cavity has furrowed away the tartar by dissolving it, *immediately below the cavity,* and showing its source to be within it.

27. In a normally balanced electro-vital action the elements appear to separate and re-combine so as to produce results in a neutral state, but which in an abnormal and unbalanced state give rise to the production of free acid, etc.; thus, in the mouth, the gums may be perfectly neutral at times, but powerfully acid at others, and yet the teeth are not acted upon by the acid unless some physical defect exists in their structure or upon their surface. If we look closely into the starting point of decay, we shall find that a change takes place first in the organic matrix either of the dentine or its enamel, and before the acid stage can be detected, and that often the same corroding action that is seen in the dentine may be shown to have taken place in the enamel previous to its reaching the dentine, as at *a* (Fig. 2, plate 1); thus showing that both substances are affected in the same way, although in a different degree, owing to the different amount of organic matter of which they respectively consist. If we take the specimen Fig. 3, plate 1, it will be seen that a corroding effect has begun at the fissure in the enamel, while a stained spot with a deeply darkened upper surface extends into the dentine*

28. Referring now to specimen Fig. 4, plate 1, we have a similar

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*This staining of the subjacent dentine would seem to be due rather to its having imbibed coloring matter from the decayed portion, than from any change itself has undergone.

formation existing in a tooth, but in an earlier stage of decay, or rather before any signs of coming decay have made their appearance: taken singly, it tells nothing, but on being subjected to electro-decalcification, new facts have become revealed. The positive or decalcifying pole was made to rest at *p*, while the negative pole was placed at *n*. After a few hour's action, it was found that a portion of *albumen had become consolidated upon the fissure a, spreading to the sound spot below it,* thus screening them from the decalcifying action of the battery, and *showing them to be electro-negative, the same as the part u.* Here, then, we have evidence of "local action," and a starting point for the commencement of the acidifying stage of decay.

29. It is well known that some forms of carbon or charcoal are amongst the most powerfully electro-*negative* bodies in nature, and when the tooth (Fig. 4, plate I) was first ground down and placed in the albumen, the *fissure was filled with a black carbonaceous mass,* which subsequently came away with the cleaning. This, then, was a negative point (charcoal) in a positive substance (dentine), and had it been left to its fate in the mouth, the negative point of charcoal, becoming imbued with saliva, would in time have become the developer of acid, and carried the process on to the stage represented in specimen Fig. 3, plate 1; further still in Fig. 2, plate 1.

30. Respecting local electro-voltaic action, Professor Groves says, "If a plate of pure zinc be immersed in dilute sulphuric acid, little or no chemical action takes place; but keep in contact with the zinc another metal, say an iron nail, and the zinc is rapidly oxidized and dissolved, hydrogen being evolved from the surface of the iron. The action is most rapid at the points most proximate to the iron; so that if the nail be laid upon the zinc, both being immersed in the liquid, the iron would seem to eat its way into the zinc. If a few iron filings be placed upon the zinc, the action will be similar, but will begin more slowly and increase as the points of iron are exposed, these latter being protected to a great extent by their being negative and coated with hydrogen. If an infinitesimal quantity of copper be dissolved in the acid, it will be precipitated in a metallic state on the negative points, and make these permanent centres of action. So, if no iron be made to touch the zinc, after a time some want

of absolute homogeneity is sure to determine a chemical action; and as any trace of metal existing in the solution will by this chemical (or rather electrolytic) action be deposited on the negative points, or those least attached, the action will continually increase, and, instead of being uniform, will be in patches around the negative centers. Thus a piece of common zinc of commerce, which contains small portions of iron and tin, will be corroded in pits and holes. With imperfectly conducting bodies the action is similar; at very short distances they conduct, and the action spreads or extends from a point to the surrounding points. The effects all proceed from a want of perfect homogeneity, either original or impressed by some very trifling circumstance, and from the fact, that points of action having once been established, the corrosion is increased by the effects it itself produces and the deposits it forms. A dentist, to cure a carious tooth, scrapes out the diseased parts, etc." The above letter to the author of the "British Mollusca,"* in explanation of "substances apparently homogeneous" being "corroded in patches or irregular hollows," with reference more especially to the shells of molluscs, affords a most perfect illustration of our present subject.

31. To obtain a practical illustration of the effects resulting from a *negative* point of carbon, a perfectly sound bicuspid was ground down so as to provide a thick section; in the enamel of this, two cuts, one on each side, were made with a fine dividing-file, and one of them filled with carbon made into a paste with saliva, the other remaining as left by the file. The section (Fig. 5, plate 1) thus prepared was placed in saliva, the positive pole resting at *p*, the negative at *n*, and subjected to about twenty hours' decalcification.

32. It will be seen that the dentine around *p*, which has been acted upon, and which was originally colorless, as also was the saliva, has become *tinged of a yellowish brown* up to the shaded part *a*; and also, that while the notch on the right hand side has been rendered wider and shallower, the notch containing the carbon, as well as the outer edge of the enamel itself, remains as *sharp as when first cut*. The decalcifying action of the positive

*British Conchology, by J. Gwynn Jeffreys, F. R. S.

pole has thus included the enamel at the top and right-hand side of the section; but the *left* hand portion, represented by the shaded part in the accompanying figure, *has been rendered negative* by the carbon, and hence *become coated* with a deposit instead. A more decisive proof of the electro-negative effect of carbon, as a source of local action, cannot be desired; and, had time permitted, there is not a question but that by a delicately adjusted balance of feeble electrical action continued over a longer space of time, all the phenomena of its producing *local* acidity might have been obtained; as has since been done with a metallic plug of tin (paragraph 34). As it is, however, its action is unmistakable; and if a piece of damp litmus-paper be pressed upon the surface, all the decalcified portion will be found to be strongly acid, while the shaded or negative portion is still neutral or alkaline.*

33. This local action engendered, it can only be stayed by removing or rendering inactive the negative part or excluding the electrolyte so as to destroy the means of further electro-voltaic decomposition; and it will not fail to be recognized that this is the exact process we invariably resort to in the treatment of dental caries. We know by experience that not only must all the injured part be removed, but we must endeavor to exclude the moisture, to prevent its relapsing into the same condition.

34. These electrical conditions may also serve to throw some light on a circumstance respecting which very little is at present known—that is, why some substances answer better for filling the cavity in a decayed tooth than others. Respecting this ques-

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* The particular acids traceable in the mouth depend very greatly upon what elements the electrolyte may have held in solution at the time, and to show that substances taken internally are detectable in the fluids of the mouth. A piece of white paper, moistened with saliva from a source where three grains of iodide of potassium were being taken thrice a day, five hours after the last dose, was touched with the platinum wires of the battery, when the iodine was instantaneously manifested by the violet stain of the starch test applied in the sizing of the paper. The deep yellow stain often seen at the necks of the teeth and in the decay of the fangs, may in the same way be communicated by minute portions of iodine in the system, as has been done with Fig. 6, plate 1, which was acted upon in saliva from the same source as the preceding.

tion a most interesting and highly important fact has just been brought to light, which may assist very materially in determining the suitability of a metallic substance for the purpose. The idea suggested itself as to what might be the relative electrical condition of the several metallic stoppings now in use with regard to the electrical condition of dentine, and it was found on experiment that white *gold* was *positive and in the same condition as the dentine, tin* was powerfully *negative*, and in this respect in the same relative state as the carbon, and consequently an unsuitable metal for a stopping. Nor is this all, for it was also found that with the *tin* plug a strongly marked *acidifying local action* was produced. A plug of tin foil was made in a piece of dentine and placed under the influence of a current of electricity; a piece of litmus paper was then moistened with salt and water, and placed upon the surface, with the positive pole resting at *p* and the negative pole at *n* (Fig. 7, plate 1). The effect after a few minutes is represented in Fig. 2, plate 2; it being impossible to preserve or dry the litmus paper without the acid. A metallic plug of gold being in the same electrical condition as the crown of the tooth, is a perfectly *inactive* agent, beyond the mere effect of pressure and confinement of any fluid that may exude from the pulp; whereas, any other metal that may be *negative* to the *crown of the tooth* induces local action, whereof the acidifying pole is opposed to the negative pole of the tooth, which is its fang; and hence this condition accounts for the decay so constantly occurring in lateral stoppings at or below the free edge of the gums (Fig. 6, plate 2.) A plug of gold was substituted for the tin, and the spot, instead of being blue, was merely reddened, without the slightest trace of local or induced action. In the tin we have a strongly marked reaction developed in the spot nearest the negative pole, which corresponds with a metallic stopping in the *side* of a tooth tending to become imperfect, most at the point nearest to the fang or negative part of the tooth, because it is here the polarity of the plug produces the polar condition which first leads to the generation of the acid. Other metals have been tried with the most decided results (Figs. 3, 4, 5 and 6, plate 2); but the comparison of them is irrelevant to the present subject, besides requiring still further investigation; the *fact* alone has only been brought forward as

another instance of the corroboration afforded by the phenomena of electricity for establishing the identity of the results occurring both in and out of the mouth as proceeding from the same physical source.

35. In pursuing the experiments in electro-decalcification, it was found that while it could be effected in water alone, there were other media by which it could be more rapidly and more extensively produced. Thus a weak solution of sugar and water was found to be more active than water alone, but albumen from egg and serum from the blood, proved far more powerful agents, partly through forming better conductors by their viscidity, and also apparently from the decomposition of the chloride of sodium they contain, forming hydro-chloric acid and chlorine; the saliva, too, is more active when thickened with mucus than in a less viscid state. Specimen Fig. 8, plate 1, is an upper molar sawed through the center of a decayed cavity. The part, *b*, is seen as left by the saw; the other part, *a*, shows its condition after twenty hours' decalcification in a weak solution of sugar and water. The pulp cavity, in the part *b*, is perfectly free from decay within, and contains large masses of secondary dentine, while the part *a*, has had the decay extended artificially, and in the absence of the negative pulp-vessels the cavity has also become enlarged. Specimen Fig. 9, plate 1, has been treated in albumen thickened with a portion of the yolk, showing that the more viscid the medium within certain limits, the more diffused will be the decalcifying effects.

36. In all cases the decalcified dentine will be found to be strongly acid, and whenever a fluid containing albumen has been employed, there is invariably found an adhering portion of consolidated substance between the two poles, as at *a* (Fig. 9, plate 1,); and, hence, we have an effect exactly similar to the production of the transparent zones which form around a decaying center, and therefore have no need to seek for the cause of the latter in a *vital* action, when it is shown to be a natural consequence of the physical condition of the parts concerned.

37. The amount of substance produced in this part, however, is but small in comparison with what takes place in the pulp cavity under more extensive excitement, the pulp itself being sometimes almost obliterated; but as these calcareous de-

posits can be so perfectly imitated by artificial means, there can be no doubt of their non-vital but physical force.

38. It will have been observed, that the pulp-cavity once reached is rarely opened out much by decay, but the carious cavity tends to enlargement laterally (b, Fig. 8, a, Fig. 10, a, Fig. 11, plate 1). Were the pulp in a positive state, like the dentine, and like the pole of the battery which rested at p (Fig. 8, plate 1), its moisture and action would have tended to enlarge the pulp-cavity so as to throw this and the carious cavity into one; but its being electro-negative, the pulp-cavity is protected from being electro-voltaically acted upon; and we see this same condition further extended in the state of the dentinal fibrils, as continuations of the pulp. Mr. Tomes has informed us that the collecting material is usually the first, and the walls of the tubes the last, to become disintegrated. So that while the negative pulp protects the cavity, the negative fibrils protect the walls of the tubes; and thus we have a constant explanation of the whole proceeding. But when this action is going on, the tendency to new formation through the electro-voltaic action, leads to the consolidation of the fibrils in the early stage, and later, to an accumulation within the pulp, while the cavity itself mostly becomes added to on its inner surface, so as to lessen its dimensions—a tendency advantageously exerted when it leads to "calcification" of the exposed surface of the pulp. But the latter action is commonly attributed to the vital powers in the tooth. Unquestionably, if there were no vital powers in the tooth, it could not take place; but the vital part of the action is confined to the circulation of the albuminous material in the arteries, veins, and capillaries of the pulp. The connection of the latter with those of the cutis shows the pulp to belong to the cutis, which is the negative layer of the peripheral battery, and to be hence endowed with the same acting powers; but all the appearance of vitality possessed by the layers outward of the pulp is *due to their being electro-voltaically arranged and acted upon*. The tooth papilla growing from its infancy to its full size and shape in the dental follicle, is purely an act of vitality by cell-growth, with a design and a purpose. But the embryo tooth thus produced is a *soft* material requiring further elaboration; therefore a secondary action of a purely physical character is

induced, which leads to its becoming coated with dentine and enamel. The vitality of the pulp furnishes the material for these changes, but the electro-voltaic arrangement of the tissues converts them by a kind of galvano-plastic process, into an organic form.

[TO BE CONCLUDED NEXT MONTH.]

GENESIS.

BY HIRAM CHRISTOPHER, M. D.

V.

The mental and moral faculties do not exhaust the psychical nature of living beings. They do not exhaust the nature of the life-agent as this is displayed in the psychical phenomena of animals. There is yet another manifestation of this nature, the development of a higher psychical attribute, whose phenomena are prophetic of a higher realm of being—the assurance, indeed, of another state of existence into which man will yet pass, thus demonstrating still more clearly and certainly the foreign source of the life-agent, of whose true nature this attribute gives the highest and the finally conclusive evidence. This attribute we call the religious sense or feeling, so apparently characteristic of man, but really common to the purely animal nature. This claim for the animal may seem still more startling, and yet it is a legitimate conclusion from the premises of the modern scientist. We know that man has a religious nature, and if he is but an animal, the creation of the physical forces, as is claimed by these modern scientists, a religious nature cannot be denied to animals, though in most of them it may be very obscure. But it is not more obscure in the higher species than is the mental nature in the lowest. As the mental and moral natures in man and animals have the same origin or basis, the conclusion is necessary,

that any difference that may be observed between them is not to be attributed to a different nature, but to the grade of organic development, through and by means of which psychical phenomena are manifested. The plane of mental phenomena appears first, then that of the moral, and lastly that of the religious. Facts establish this order of sequence. They appear as the organism is suited for their manifestation. So that we have only to consider the religious sense or nature as the ultimate development which the life-agent makes of itself through a living organism, in order to see that one nature is as truly an attribute of the life-agent as the other. For, however surprising it may be thought to be that the religious sense is an attribute of animals, a faculty of their psychical nature, it would be far more surprising if such were not the fact. All these natures or faculties rest on the same basis, and are attributes of one and the same power or agent. They appear coetaneous with organic development because a certain development of structure is necessary to their development respectively. It is, therefore, plain to see that the presence or absence of either one or all of these faculties from a living organism is to be ascribed to the grade of the organism. The religious sense appears toward the human end of the animal series, because there the animal organism has attained the necessary development. These facts being incontrovertible, the conclusion is evident and necessary, that the mental, moral, and religious natures rest on, and proceed from, one common basis or nature of which they are inherent attributes.

This conclusion is a logical necessity, but it would have but little, if any, force as an argument, for the existence of a religious nature in animals, if such a nature were not perceptible in them. We should distinguish between the moral and religious natures. In general the distinction is very apparent; but in some cases the moral shades so gradually into the religious that the line of demarkation becomes very dim. The love, for instance, that belongs to the moral nature—the love of a subject for his king—can hardly be distinguished from the love that borders on, or reaches, reverence. So as regards the love of the young for the aged. It is not the love of the child for his parent, but rather like that of an inferior for one regarded as superior. Such a love has in it something of the element of rever-

ence which belongs to the religious nature. The attachment of friendship is almost as conspicuous in animals as in man. The difference is to be found only in the degree with which the feeling is felt and its consequent duration, or in the manner in which it is expressed. The grade of organic development is, *cæteris paribus*, the measure of the manifestation of this and all other faculties, feelings, and attachments observed in animals—the measure and means of the life-agent's development of his nature. The attachment of the dog for his master is not only of the moral nature of love, but approximates very closely the feeling of reverence in man, if it be not actually identical with it. It is most probably the same sentiment in a lighter or feebler degree. It may, indeed, be more than this; for few men ever manifest such a degree of reverence for the Deity as does the dog for his master. In this respect he is an example for his more highly endowed master, whose cheek should crimson with shame when he contemplates the devotion of his humble companion. So strong and conspicuous is this devotion of the dog for his master, that men in every age of the world, and in every country, have observed and admired it. The cultivated Greek noted it, and from the evident devotion of the dog for his master, formed one of the most expressive words of his language; a word which expresses the reverence of the servant for his master, the inferior for his superior, and man for his Lord—*proskuneo,* to reverence or worship. We may, therefore, regard it as an unquestionable fact, that animals have a religious nature in common with man, and, consequently, that a religious nature inheres in the power that gave origin to the animal kingdom.

The *terminus ad quem* for this nature in animals is man, since he is, in all essential particulars, their superior. We know that he is as respects the dog, and as this animal is, of all animals, the most highly endowed in this respect, man may be placed as the *terminus* of all the higher feelings and affections of the animals associated with him. But who or what is the object of man's reverence or religious adoration? On whom does the exercise of his religious faculty terminate? This question directs our attention still in a forward direction—points us to an object still beyond us and before us, and suggests that the power which planted in man this feeling or nature, had the foresight of pur-

pose and the precision of design; that the life-agent possessed a mind of wonderful reach and grasp, and capable of the grandest designs that ever mind contemplated, or conceived of; designs that required means for their realization, attainable only by one infinitely fertile in resource, and omnipotent in power. But further.

To the moral nature belongs the feeling of shame, and shame comes from a consciousness of wrong-doing. It is the feeling of a smitten conscience. This feeling is conspicuous in man, but is not peculiar to him. It ought to be found in animals that clearly manifest a moral nature. If we observe closely the conduct of the dog while under the displeasure of his master, we cannot fail to see that his actions indicate that he is ashamed of what he had done that offended his master. He is conscious of having done wrong, and shows that he is ashamed of it. This appears in his actions—in the expression of his features, in the motion and position of his body and limbs; his tail is drawn under him; he crouches to the ground, and shows in the expression of his eyes, that he is deeply ashamed of what he has done. His conduct can be explained on no other hypothesis. He skulks away because he fears punishment, and feels that he deserves it.

At the point of shame the moral nature shades into the religious. It proves the consciousness of wrong-doing, and from this there is a looking up to a superior for pity. Can we conceive of an action that more earnestly and expressively pleads for pity than do the actions of the dog when he crouches at the feet of his master, dreading his displeasure? From reverence comes this pleading for mercy, and in such a petition, shame and reverence meet. Here the two natures show their identity and community of origin.

As shame begets the fear of punishment, we have in this fact the development of another psychical faculty of the animal nature—*anticipation*. This looks forward only. Its object lies in the future, whether near or distant. In the animal it is mostly the near. The beaver is said to build his dam sometimes on a higher level than before, in anticipation of a more than usual high water. This may be the impulse of what is called instinct. Be it what it may, the action is based on anticipation, though

the animal is hardly concious of the feeling at the time. But the fear of punishment on the part of the dog is felt. It is the anticipation of a near event. Whether anticipation in mere animals is a matter of consciousness as respects events more distant than the near future is very doubtful; but whether so or not, the fact proves the existence of such a faculty in the animal mind, and this is all we desire at present.

Anticipation is excited by events expected, and events are expected because of information in possession of the party. We know not how or why the beaver anticipates an unusual rise of the stream on whose banks he builds his home; but the dog anticipates punishment because he has learned by experience that it will follow his wrong-doing. We have no reason for supposing that the animals below man have, from any source of information open to them, the anticipation of an event that lies beyond the immediate future. They cannot unless they have the necessary knowledge from a source besides their own experience. Such knowledge they have not, nor are they capable of appreciating such information if it should be given. They can have no conception of a future state of existence, and hence they cannot have such an anticipation. They have not the knowledge necessary to excite such an anticipation, and cannot have. Hence such a conception as a future state of existence, or the anticipation of such a life, is impossible to the mere animal.

But man has the conception of such a state of existence. He believes that he will live somewhere else after the death of his body. He anticipates a life beyond the grave. He has the knowledge of such a state, or believes he has. The majority of the civilized world believes this. Whence, then, the source of the information which gives origin to the conception, and excites the anticipation of a future life? There can be but three sources of this information: (*a*) From a supernatural or divine revelation; (*b*) from intuition of the personal spirit-being which temporarily inhabits the animal body, or (*c*) from intuition of the *animal* mind. The modern scientist will reject the first two as not within the province of science, which is true, if he means physical science. But a denial of these sources of information does not help him out of the difficulty. The fact that man an-

ticipates living beyond death is not pushed aside by denial. It is a phenomenon that man submits for explanation, and the scientist must explain its origin. According to his views as to the origin of living beings, and the nature of psychical phenomena, he must say that the knowledge is an intuition of the animal mind. This being so, we have physical forces creating a mechanism out of the atoms of dead matter with powers of mind capable of the conception of a future state of existence, and of attaining, of themselves, the knowledge of such a state. What difficulties and inexplicable mysteries seem to accumulate around the theory that physical agents are the authors of such strange phenomena!

We may admit intuitive knowledge for man as respects axioms or self-evident truths; but is the knowledge respecting the existence of man beyond the grave, intuitive? No one asserts or believes that it is. Then whence the conception and the belief of the supposed fact? The information that has excited the anticipation, and planted the belief in the mind of man, must have been imparted by one who knows the fact. There is no other possible source from which the information could have come. But this is denied by the modern scientist. He is, therefore, confronted with a fact which he cannot explain, nor deny.

Animals have an instinctive fear of one another, a feeling implanted in their nature for their personal protection by means of escape. Such a feeling is organic, and has no connection with the volition. It is inherent, not acquired. There is a wide difference, however, between instinct and intuition, though neither has any connection with, or dependence on, volition. There is abundant evidence of the existence and action of instinct in animals, but none whatever of intuition. Why they fear, therefore, is to be explained on the ground of instinct, or imparted knowledge. The dog fears punishment from his master, not by instinct, but from a knowledge of the past. He apprehends what the action of his master will be when he has displeased him, because he remembers what it was in the past. Then having the faculty of anticipation, that faculty is excited by imparted knowledge. The same is true of man. His instinct and intuition can give him no knowledge of what will happen in the distant future. For all knowledge of this kind he is es-

sentially dependent on information; and hence the anticipation on the part of man as respects a future state of existence—universal with the race—can arise only from imparted information. This is a fact that needs explanation, and as the scientist has no means of giving it, he must confess that there are phenomena which his theories do not, and cannot explain.

The scientist cannot complain of the introduction of this argument in the discussion as irrelevant, or deny its right to consideration as a legitimate question of science. He has affirmed that *all* psychical faculties are but the *powers* of a material mechanism, created or generated by physical forces, and purely organic results of these agents, and if his science cannot explain *all* the phenomena presented by human beings, he should confess its inability, and be willing to receive a higher generalization as to creative powers than what is presented by the physical world. If we shut out all other light, we leave unexplained a psychical phenomenon of no little importance. The modern scientist confidently affirms that all art, poetry, philosophy, and science arise from a power or force that had its origin in the fires of the sun, and was identical as to nature, with the heat that ignited the combustible material of our once burning world, and there is, hence, no escape from the conclusion that anticipation, as a faculty of the mind, is a legitimate product of the same physical force or agent, and that the knowledge which excites this faculty to look forward to a future state of existence, is either instinctive or intuitive, or within the phenomenal.

From this we may take another step forward, and introduce the beliefs of mankind as phenomena that call for explanation on the theory held by modern scientists. Belief is based on testimony. The beliefs of mankind, which come of imparted knowledge—from knowledge unattainable by human effort, and beyond the domain of the phenomenal—*when they bear on the question of man's genesis and nature*, are legitimate subjects of scientific investigation; as much so as are the psychical faculties and phenomena of animals and man. If these are the product of a force akin to that which forms the crystal or salt, they are as truly subjects of scientific research as are these physical bodies. Mankind anticipates, and believes in a future state of existence. This is a fact to be explained. The dog anticipates and fears

punishment, being conscious of wrong-doing as respects his master. The knowledge that excites the faculty and arouses his fear, is derived from his personal experience. It is not instinctive nor intuitive, but imparted. The knowledge which has excited the faculties in man, and aroused his hopes or fears, is also imparted; it is not instinctive nor intuitive. The knowledge of the animal came from his master; the knowledge which man has of a future state of existence must have come from one who knows the fact. It will not be claimed that physical agents or forces have this knowledge, nor that the phenomena of nature have even suggested it. Whether, as a fact, man has this knowledge from without; whether as a fact this knowledge has come to him from a supernatural source, it is neither our province, nor duty to prove. We simply urge the *fact* that mankind do anticipate living after death; that they have hopes and fears respecting their destiny beyond the grave, and argue from this fact that there must be in him something that *can* live and *will* live after his body has utterly perished.

The scientist may insist that the anticipation of a future life is but a dream or a superstition. Be it so; he has then another difficulty on his hands, and equally impossible of explanation—whence or how the *universality of the dream or superstition*, and that, too, by the best minds, pagan as well as christian, that have ever adorned our nature? To object is not to explain. Here we have a psychical faculty and a psychical phenomenon. If *all* psychical faculties and phenomena proceed from the molecular action of atoms, or from the *functions* of an atomic organism, the former cannot be excluded from the latter, or discarded as not phenomenal, and beyond the field of scientific investigation.

The universal belief of mankind, (always excepting, by courtesy, those who believe they are naught but developed monkeys,) is, that man is not only an animal, essentially the same as the animals below him in the graded series; but that he is also a spirit-being; that there dwells in his animal organism during its life, a spirit-being, who will survive the death of the animal, and live elsewhere, in a state now invisible to us. Now, until the scientist shall satisfactorily explain this fact, and on the principles of his science, we are justified in assuming as a fact

that there is in man a being who will survive the death of his body. The hopes and fears of mankind; the anticipation of a future life by the best minds of our race, demand such a constitution for man in his entirety; and as the assumption, necessitated by the expectation, explains all the facts involved in the supposition, we are justified in believing that man is more than an animal.

Now, as we have a spirit-being in man, who will live after the death of the animal organism, may we not ask this "cosmic vapor" school of scientists, Whence this personal being capable of an existence independent of the body? Whence its genesis, and how came it into the animal organism? Was it the "cosmic vapor" or "fires of the sun" in conjunction with the life agent, that built up the animal organism, and awaiting the time when physical forces should deem it time to prepare and make for it a body? Or was it there in an impersonal form, nebulous or vapory, an invisible and an amorphous essence awaiting the day when refrigeration or cohesive attraction should condense it into the personality in which it appears in man, and then draw it into his body? This, or something like it must be conjectured or assumed, if man in all his entirety is the creation of physical agents, and his psychical phenomena purely the result of molecular activity.

The absurdities into which false views drive us, are proof of the fallibility of human reason, and give a warning that should not pass unheeded. There are difficulties presented by the phenomena of the world, which reason cannot remove; facts which it cannot explain; and problems which it cannot solve by scientific methods. There is such a thing as belief based on testimony, and there is testimony which consists of insoluble facts; and our highest reason demands that we shall believe and receive the latter as established, when the testimony is ample and competent.

This strange unbelief under so much infallible light, is itself a psychical phenomenon of no insignificant character. Is the question as to the genesis of the organic world so environed with difficulties, and so involved in doubt, as to be unknowable? As the scientist has failed in all his efforts to prove the creative power of physical forces, and uniformly and invariably failed; and since we have information which thousands of men of the

highest attainments and greatest ability believe to be true and authentic, and which dissipates all doubt that can hang over the subject, why should the scientist still persist in holding to theories which cannot bear the test of reason? Is it perversity, or honest skepticism? Does the scientist ever find such phenomena as these in the play of physical forces? Are they capable of such action? He knows they are not; and yet he can see no specific or categorical difference between physical and psychical phenomena.

The stream cannot rise above the level of its source. This the scientist knows and teaches. He knows it to be a physical impossibility. And there cannot be in the effect what was not potentially in the cause. This the scientist also knows is equally true. Profs. Huxley and Tyndall affirm this as true and, indeed, necessary, when they declare that mind is the legitimate product of the action of physical agents; that the dynamic forces active in "the fiery mist," were truly and really the originative and generative source of all phenomena, physical and psychical, that appear in the two great departments of this mundane system. As respects the latter kingdom, the theory of evolution fails at its initial point—spontaneous generation—and is, therefore, untrue in every particular. On the contrary, the view that assigns all existence, and all phenomena of all worlds to one infinitely intelligent, wise, and powerful Being, himself unoriginated, self-existent, and eternal, not only meets and satisfies all the demands of the problem, but shows by the facts on which the view is based that no different view can be true. It embraces and accounts for all facts and all phenomena that have ever, or will ever, come under the observation of men, and disposes of all difficulties which infinite variety and complexity have occasioned in the minds of men. What phenomena it leaves unexplained, or questions unsettled, we may consider as not within the limits of finite intelligence. That there are such phenomena and questions may be readily admitted, since all things are not possible to the finite mind. But explaining all, and settling all that are within man's grasp and understanding, reason and every principle of science demand that the hypothesis of an intelligent creator, shall be accepted as ending all controversy respecting the genesis of the material and organic worlds, and all their phenomena.

GALVANIC ACTION WITHIN THE MOUTH—ITS RELATION TO DENTAL SURGERY.

BY GEO. WATT, M. D., D. D. S.

Coming from the medical into the dental profession, I fancied that dentists had paid less attention to chemistry than to other sciences collateral with dental surgery. This fancy had much to do in guiding my own thoughts and efforts in the endeavor to contribute my share toward the advancement of dental science. And whether or not this fancy was founded on fact, I certainly noticed less distinctness of thought, in reference to the chemistry of the mouth, than I found on other subjects. And this was especially true, in regard to the chemical results of galvanic action in the mouth. Hoping mainly to aid my immediate classmates in mastering this subject, I made it the theme of an inaugural thesis, when a student in the Ohio College of Dental Surgery. (See "Intrastomatic Galvanism," in Watt's Chemical Essays.)

Within the last few years, much thought has been bestowed on this subject, especially by two or three members of the profession. The industry manifested by the brethren referred to, is highly commendable, and is, I hope, duly appreciated by us all. With reluctance, let me say, that a closer attention to elementary principles would have saved much labor, and would have guided to more correct conclusions. Finding still a great lack of clear thinking on galvanic action within the mouth, without attempting to criticise any one, I will offer a few spontaneous thoughts, without reference to authorities and text-books, and with but little effort toward systematic instruction, aiming to write just as I would talk to my most familiar personal friends; for what else am I now doing? And if the first person, singular number, should appear too prominent, I hope you will regard egotism as not more assuming than *we*-gotism, and that you will remember, without frequent mention of the fact, that every statement herein is simply "according to my humble opinion."

Then, for galvanic action within the mouth, and its relation to dental surgery.

Galvanism is modified electricity. An apparatus for setting in motion, or developing this condition of the electric fluid, is called a galvanic battery. Batteries are of two kinds, essentially, and each kind is subject to various modifications. One is composed of two perfect conductors of galvanic electricity, and an imperfect one. This is the more common variety. The elements of the other kind are one perfect and two imperfect conductors. This is less common, and as it is, neither by intention or accident placed within the mouth, it may be dismissed from present consideration. Only the first variety is of practical moment to the dental surgeon, and bearing in mind its constituent elements, remember also that unless the imperfect conductor acts chemically on one of the perfect ones, galvanism is not manifested. If it acts on both, it must act unequally, or no current is established. For illustration of these principles, think of the most common batteries. Zinc and copper are called perfect conductors; while the acidulated water, or saline solution, is an imperfect one. Though the metals differ in conducting power, they are called perfect conductors, as they relate to galvanism. In the zinc and copper battery, just referred to, the liquid acts on both metals; but, as it acts with more energy on the zinc than on the copper, galvanic action is manifested, and the greater the difference in the action on the two plates, other things being equal, the greater is the galvanic manifestation. Hence, if the copper is replaced by a metal which totally resists the action of the fluid, there is a gain in the power of the battery. In Groves', and some other batteries, platinum is used instead of copper.

If the two plates of a battery, say zinc and copper, are placed in the exciting fluid, they assume opposite electric states, when not in contact with each other, or when not united by a metallic conductor; but there is only static electricity. But when brought in contact, either directly or by an intervening metallic conductor, the electricity is set in motion, and what is known as a galvanic circle is established. Such an electric current is a potent agent in chemical decomposition, but it has its limits, to be hereafter noticed.

Decomposition, by a galvanic current, is called electrolysis. A substance which can be so decomposed, is called an electrolyte. A conductor conveying a galvanic current into an electrolyte, is called an electrode. In practical chemistry, the electrodes, usually wires, convey the galvanic current into the electrolyte, generally contained in a vessel or reservoir at a greater or less distance from the battery. The preparation of A. J. Watts' crystal gold, is a beautiful illustration of this. But nothing analogous to such electrolysis ever occurs within the mouth, and if some of my brethren had duly appreciated this, they would have been saved much labor, with less confusion in their teachings. While decomposition is taking place in the receptacle where the electrodes terminate, to exactly the same degree is the liquid in the battery decomposed, provided that the battery is perfect, for all parts of a galvanic circle equal each other in quantity and power. This electrolysis, or decomposition, and this only, is analogous to that which may and does occur in the mouth. Had this been always borne in mind, the time and trouble of many experiments, which throw no light on this subject, might have been avoided.

It has been intimated that electrolysis has its limits—only liquids can be electrolyzed; but how often do we hear of tooth substance—or dentos, whatever that may be—being decomposed by electrical currents! Water is readily electrolyzed, but ice, never. And not all liquids are electrolytes. Some, as alcohol, will not conduct galvanic currents at all, and, of course, cannot be decomposed by such currents. And, further, only binary compounds, that is, such compounds as contain but two elements are decomposed by galvanic currents. Let not this be misunderstood. A liquid may be able to conduct galvanic currents, while it holds in solution a number of binary compounds. The current will decompose these in the ratio of their chemical equivalents. For example, in the mouth is found water, chloride of sodium, chloride of potassium, and sometimes ammonia, sulphurretted hydrogen, etc., each containing but two elements, and each, therefore, subject to electrolytic decomposition.

Thus far reference is had to true electrolysis—true galvanic decomposition, but the chemical action of agents thus liberated must not be overlooked. And these secondary actions must not

be confounded with electrolysis, as has been far too common, I fear, by very many of my professional brethren. Very much of the chemical results of galvanic action is due to the affiinities of the elements thus set free, which being presented in their nascent state, have the increased energy incident to that condition. If a tooth is in any degree disintegrated or corroded, as a result of galvanic action, the phenomenon is due to this secondary action, and never directly to electrolysis.

I regard the subject as greatly simplified, when this is clearly understood. Confusion of thought has resulted from an unprofitable discussion of the direction of the galvanic current in the battery, and along the electrodes. By confining our thoughts to the battery alone we gain clearness of view. All galvanic action within the mouth is analogous to what occurs here. To aid the memory, let us examine the action within the ordinary battery. If a strip of pure zinc and another of copper are placed in a lquid composed of sulphuric acid and water, and these strips are allowed to touch each other, or are united by an intervening metallic conductor, something takes place. The oxygen of the water unites with and corrodes the zinc; but when water yields oxygen, a corresponding equivalent of hydrogen is liberated. The gas being but slightly, if at all, soluble in water and unable to unite with either of the metals, escapes in bubbles, but only at the surface of the copper, if the battery is perfect. In the entire list of elements, oxygen and hydrogen are at opposite extremes of the electric scale. Oxygen is always more highly electro-negative than any other element, while hydrogen is more electro-positive than any other. But, as we have seen, oxygen goes to the zinc in the battery, and this because the zinc is positive, or in an electric state opposite to that of the oxygen. And the hydrogen goes to the copper, because it is negative, a state opposite to that of the hydrogen. Hydrogen is probably a metal. Now remember that all the metals take the same direction, when separated from the corrosive elements by electrolysis; and the corrosive, such as chlorine, sulphur, fluorine, etc., follow the example of oxygen. This brief statement, retained in the memory, affords a key to almost any supposable case of electrolytic decomposition.

To remember the direction of the positive current in the gal

vanic circle, we need only recall the fact that the zinc or corroded metal is positive. The current passes from this through the liquid to the copper, or uncorroded metal, along this to the electrode or connecting metal, and back to the zinc. The negative current, equal in power and velocity, traverses, simultaneously, the opposite direction; and this is the reason that telegrams can be sent in opposite directions at the same time on a single wire.

A singular attempt has been made to apply a knowledge of the direction of the positive current to practical use in filling teeth. I allude to the suggestion that different metals be so arranged, in the same cavity, that a positive electric current will pass from the tooth substance to the filling, as if it were the current striking the tooth that destroys it. An old hunter used to show me how smoothly polished he kept the front sight of his rifle by looking along it. The two propositions are equally sound. But after all, guiding the positive current from the tooth to the filling, is only guiding the equally powerful negative current from the filling to the tooth.

Circumstances being equal, the quantity of electricity set in motion by a galvanic battery is directly in proportion to the surface excited. A pure zinc plate four inches square will give off sixteen times the quantity afforded by a similar plate an inch square.

Another elementary fact, often ignored, is, that the decomposing powers of batteries, other things being equal, vary inversely as the square root of the distances between the plates. When the plates are one inch apart the decomposing power is twice as great as when they are four inches, and four times as great as when they are sixteen. And in like manner, when they are a fourth of an inch apart, the power is double that of one inch, and is increased four-fold when they are but a sixteenth of an inch. An imperceptible distance (apparent contact) is many times less than a sixteenth of an inch, yet the increase of power is governed by the same law. The practical electrician sees daily illustrations of this, on account of the impurities of the zinc of commerce. Small particles of iron are often diffused through the zinc, which, with the latter metal, form an infinitesimal series of minute batteries of wonderful decomposing

power, as is manifested by the great abundance of bubbles caused by the escaping hydrogen. This is an illustration of true electrolysis, as good as any known to electro-chemical science. The ultimate elements are separated in accordance with their relative electric properties, each going to the metal whose electric state is the opposite of its own.

Now suppose we place a plate of impure, commercial zinc, in a liquid containing not only water, but chloride of sodium, sulphuretted hydrogen, and ammonia. Here are four binary compounds, liquid, capable of conducting galvanic currents, and acting on the particles of both the zinc and iron, but with the greater energy on the zinc. The water will be electrolyzed, and it is easy to remember that its oxygen goes to and corrodes the zinc, while its hydrogen goes to the iron, and escapes in gas bubbles, unless it there finds something with which to combine. But the salt is also electrolyzed, its chlorine being a corrodent, follows the oxygen, while the sodium goes to the iron. Sulphur goes with the oxygen—its hydrogen of course to the iron.

When we reflect that these corrosive elements are brought to the zinc, in obedience to electric attraction rather than to chemical affinity, we can readily see that their corrosive action need not be, and is not all spent in corroding the zinc. When liberated they are free to obey the laws of affinity. But it is well known that nascent chlorine takes hydrogen from almost any compound containing it. The disinfecting and bleaching properties of chlorine are mainly due to this fact. It will, therefore, take hydrogen from water, forming hydro-chloric acid, and this at the zinc. Ammonia composed of hydrogen and nitrogen, if present, is also electrolyzed; and hydrogen being always electro-positive, of course the nitrogen has to go to the zinc, and as it there, in its nascent state, finds oxygen also nascent, combination takes place, nitric oxyd being first formed, which in the presence of air and water, is rapidly changed to nitric acid. It is on this principle only that the white variety of dental caries is ever found as a result of galvanic action within the mouth.

It might prove unprofitable to notice all the modes of producing galvanic action within the mouth. If I can say enough to awaken an interest in the subject, and to develop clearness of

thought in reference to it, among my fellow members, this to me, laborious effort, will reap its full reward.

I fear that a few of my brethern misapprehend sometimes, and suspect the presence of galvanic currents in the mouth when the conditions necessary to their production are not present. For example, some have inferred that gold and platinum, in contact in the mouth, will give such results; but how can this be unless the fluids of the mouth corrode at least one of the metals? which is not likely to take place, unless in highly abnormal conditions. Again, when a cavity is partly filled with tinfoil, and the plug is finished with gold, there is often pain and irritation, on change of temperature, within the mouth. This is usually spoken of as a result of galvanic action, which it can hardly be, unless the plug leaks. The pain is ordinarily due to what, in the text books, is called thermo-electricity. Also, when two metals are placed in the mouth, and one is corroded by the buccal fluid, if they are not in contact, and if there is no better conductor connecting them than the fluid itself, the metals assume opposite electric states, but no current is established and decomposition of the fluid does not take place. The condition is that of static electricity. But if the metals touch each other or both touch the mucous membrane of the mouth, a regular circle is developed and decomposition occurs in proportion to the quantity of galvanism thus set in motion. A gold plug and any one of base metals may constitute such battery, and let us suppose these plugs are in adjacent teeth, and in contact with each other at a given point, or both in contact with the gum at the necks of the teeth, the binary compounds in the buccal fluid must be decomposed, but how? Water and soluble chlorides are present in all mouths. Then, of water, the oxygen, and of the salts, the chlorine, go to the base metal, and the hydrogen of the water, and the metals of the chlorides go to the gold. But we have already seen that nascent chlorine takes hydrogen from compounds containing it, hence, hydrochloric acid must be formed at the base metal. And this is why we so often see the most common variety of dental caries about the margins of the base metal plugs; this decay being always the result of the action of hydrochloric acid.

Rape is a crime unknown in chemistry, and there is no social

restriction among the elements demanding that one sex shall do all the courting. Hence, when the hydrogen reaches the gold, it takes chlorine from compounds containing it, as promptly as itself is captured by the chlorine at the other side of the battery. But by this combination we have hydrochloric acid again, and this is why we so often find the same variety of decay around the gold filling. At the other side much of the force of the chlorine, as well as of the acid, is spent in corroding the base metals, while neither the hydrogen nor the acid can attack the gold; but all the force of the acid is spent on the tooth; and thus the tooth with the gold plug is, in such cases, more corroded than that with the base metal, which leads some to the conclusion that the base metal is the better filling. A similar arrangement, with the same results, may be made by a gold plate and a base metal plug, as well as by other means which may be omitted from the present discussion.

When a gold plug leaks, there is apt to be galvanic action. The organic matter of dentine is a conductor, and in this case, represents the corroded or zinc side of the battery. Hydrochloric acid decay occurs in such cases, when the buccal fluids are normal, but when ammonia is present, we may have white decay co-operative with it, owing to the formation of nitric acid by electrolysis of the ammonia.

The "amalgam question" would be entirely omitted here, if faithfulness to science would permit. Its general bearings, of course, lie beyond the range of this paper. Only as amalgams are factors in galvanic action within the mouth, will they be noticed, and even in this aspect but briefly.

The word "amalgam" always implies that mercury is one of its constituents. Probably the first one used in filling teeth was composed of silver and mercury. That most extensively used for many years, contained tin, in addition. This may be taken as a type of the race, without stopping to discuss special formulas. Satan is the devil still, even if clothed in the garb of an angel of light; and the ass brayed when he tried to roar, although covered with the skin of a lion.

Very few will claim, I think, that amalgam plugs are pure alloys, in the same sense that brass is an alloy of zinc and copper. The alloy prepared ready for the mercury is made by comming-

ling or fusing together, metals without any reference to their chemical equivalents, and in some cases by using metals which will not combine to form a true alloy. Then the mercury is added by guess work, and its excess is squeezed out till the operator thinks he has squeezed it sufficiently tight, and guesses about enough free mercury has escaped; and, although in amalgamating there is much more oxidation in some cases than in others, he guesses that will make no difference, even if it should change the proportions of his metals, which he guessed were about right at the start; and he guesses he can fill with amalgam, even if he cannot with gold.

The scientific metallurgist will tell you, that while there is something of the alloy in your amalgam, there is, at the same time, much of the mechanical mixture. At best it is analogous to commercial zinc, as an exciter of galvanic action in a corrosive fluid. Tin has less affinity for oxygen than either silver or mercury. The infinitesimal particles of tin become negative, while the corresponding particles of the other metals are rendered positive. As the distances are imperceptible, the decomposing power is very great in proportion to the surface excited. Thus an amalgam filling has, within itself, all that is necessary to electrolyze the binary compounds of the buccal fluids. It may also act as the positive or corroded side of a battery, when in the proper relation with a gold plug or plate; but its principal galvanic power is as already described.

But this paper, much too long, must be brought to a close. I hope the hints herein set forth will aid my fellow members to clearness of thought in reference to this important subject. Allow me to say that I have not used, in this paper, the latest chemical nomenclature. I am more familiar with the old. Probably a majority of my fellow members are too. It will thus better accord with my previously written essays, should it be published with the proceedings of this meeting. And as technical terms are avoided as far as practicable, I hope my younger brethren, who are more familiar with the new nomenclature, will have but little difficulty in following the thoughts set forth. Allow me also to say that this paper is written for this society at the request of some of its most active and experienced members.

CYSTIC TUMOR OF UPPER JAW—HISTORY, DIAGNOSIS AND TREATMENT.

BY JOHN S. SMITH, D. D. S., COLUMBIA, PA.

Mrs. S., aged about 28 years; sanguino-lymphatic temperament; presented for advice and treatment at the suggestion of the family physician, I. K. Lineawever, M. D., in Feb., 1877. The lady is of American birth, but of German extraction, her parents emigrating to this country many years ago, and so far as we could learn, being of good constitution. The patient, formerly of a lively disposition and of strong consitution, enjoyed good health up to the latter part of 1877, but now presents an anæmic appearence; has lost considerable in weight, and is somewhat depressed in mind; the appetite is poor; sleep is unsound, and the general nervous functions are deranged. She appears to be quite anxious concerning her condition.

PRELIMINARY HISTORY OF THE CASE.

She tells us, about two years ago, she received a severe fall upon a board walk. In falling upon the board she broke off the left central incisor close to the gum, and also fractured the enamel of the lateral transversely, receiving other slight injuries about the face. She immediately visited her dentist who attended to her injuries; afterward a pivoted crown was placed upon the broken-off central, the lateral receiving no further treatment, except what was employed in reducing the inflammation. A few months after the tooth was pivoted, she observed a small lump about the size of a pea upon the gum over the pivoted root. Causing no pain she allowed the matter to escape her mind for the time, paying no further attention to it, not suspecting for a moment that anything serious would be the result. However, about a year later a marked increase in the size was plainly noticeable, but having as yet experienced no inconvenience, it was allowed to take its course, until the lip began to bulge, causing a disfigurement of the face (this was about January, 1877). She had previously noticed a slight discharge of a

peculiar substance into the mouth, accompanied with a disagreeable taste upon rising in the morning. She became alarmed, and visited her dentist. She got little satisfaction, or encouragement regarding the case. She had become much depressed in spirits when we first saw her, about February 11th, 1877.

DIAGNOSIS.—The case before us, we readly observe, is one of more than ordinary interest to the pathologist and oral surgeon. Before giving an opinion, or making an attempt to operate, we will carefully examine the tumor so as to be certain of the nature of the case as it first came under our treatment. We will therefore raise the lip to get a distinct view of the tumor. (Fig. 1.) We notice it is oval in form, and about the

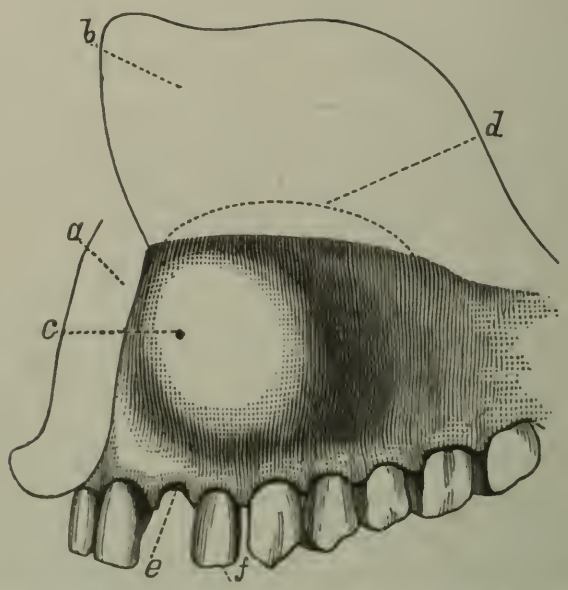

FIG. 1 shows the external walls of a cystic tumor of the left upper jaw, with the teeth in position, with well defined borders, oval in form, embracing in its extent both the central and lateral incisors, and partially including the canine.

(*a.*) Incision in lip. (*b.*) Lip thrown back. (*c.*) Limited internally by incisive foramen. (*d.*) Outline of tumor. (*e.*) Root of central removed. (*f.*) Lateral [dead] removed twelve days afterward. [Natural size.]

size of a hulled walnut, with sharply defined borders, the walls of which are tough, compact and unyielding, with but one exception, upon the apex; with the index finger we can feel a very slight sensation of fluctuation. In some cases these walls feel like parchment; crepitate slightly under pressure. In this

case we have an exception. When a case like this has been of long standing, the walls gradually thicken from the base upward (through the agency of so called cells that may be present) the sharply defined borders become tough and unyielding, and when of large size, the walls obscure the sense of fluctuation; all of which makes them look at first formidable, and can readily be mistaken for a solid tumor. We find no fistula opening, either upon the gum, facial wall, or at any point remote from the tumor; we are positive, therefore, it is not a chronic alveolar abscess. The teeth upon this side of the jaw are spread laterally. The fang of the central and lateral incisors are loosened. The crown of the lateral presents a dark appearance. Upon pressure we noticed a slight exudation of brownish, viscid fluid escaping from the root canal of central (the pivot having previously been removed). This now confirms the correct diagnosis of the case, and in view of the above facts we unhesitatingly conclude that the tumor is of cystic formation. However, we would make another appointment with the patient for an operation.

Patient returnes according to appointment. We announce to her, that to make further examination of the case, we will remove all teeth that may be directly involved, taking care to be as conservative as the case would permit in that direction; just here we will state, that in no case should the outer walls of the tumor be punctured.

Having now the confidence and complete control of the patient (which, by the way, is quite an item to success), we will select a fine root forcep and carefully grasp the formerly pivoted root, deeply embedded in the body of the gum directly involved, and bring it away so as to give more vent to the fluids secreted within the cavity. The root was quite opaque, showing marked signs of atrophy. The fluid which escaped by pressure was of a brownish tint. The lateral incisor was allowed to remain for the present.* We could now make thorough explorations through this opening. By selecting a suitable probe, we made explorations in the direction of the canine. Carrying the probe

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* The lateral was removed at the suggestion of my friend Dr. James E. Garretson, of Philadelphia, whom I consulted in regard to it for the patient's special benefit in its retention.

upward and backward, we could plainly feel the root of the canine at the apex. We find that resorption has already made considerable breach in the body of the bone beyond the apex of the lateral; the canine, however, is still pretty firm, so we have hopes of its retention. The bicuspids and first molar are not involved, therefore the antrum is not diseased. The cyst has extended beyond the limits of the alveolar process, and resorption of the spongy tissues has taken place and the connection with the alveolar border is broken, the most of which has been resorbed.

A slightly hooked probe carried along the inner facial wall reveals it to be rough and corded, like net-work. Directing the probe upward and toward the incisive foramen, the inner surface is also rough, and at no point did we penetrate a closed sack or membrane, but what was well organized, tough, fibro-cellular in structure, which would incline us to classify the tumor with the *serous, fibro-nucleated group*, in the structure of which the filaments are commonly mingled with nuclei, or nucleus fibres, and are variously interwoven in a single layer, or in many, that are separable.

As regards the pathology of the case, however, we can say but little in this connection. The pathology of all morbid growths are involved in much obscurity, cystic formations being not the exception; however the microscope has of late years done much in this direction. Of their origin we have but little to say upon the subject.

Observation, however, would lead us to trace the cause more to the perverted nutrition of the parts directly involved, than to a general morbid state of the system. The alteration of the blood into a morbid state by some latent cause, however, no doubt influences to a degree the recuperating tissues after injuries, so as to superinduce a tendency to hypertrophy. It is thought that in many instances cysts arise from alteration of vital properties of some of the molecules of the textures in which they may be developed; so that instead of being assimilated to the textures and conforming to the ordinary laws of their growth and decay, these molecules spring into existence and attach themselves, more or less independently of the adjoining living parts. Vogel's observations led him to suggest that cysts

may have their origin in old abscesses which have never opened, and whose pus has gradually undergone transformation. Our observation in this connection, and the circumstances surrounding the case in point, during and prior to its development, would at least seem in a measure to confirm the above observations of that eminent investigator.

Treatment.—No further surgery was employed in the treatment except the removal of the lateral incisor, whose pulp was found to be dead, crown free from caries, perfect except the crack in the enamel, which showed no signs of disintegration.

Local Treatment.—Syringing the parts thoroughly through the empty alveoli with tepid water, afterward injecting a pretty strong solution of tannic acid, and tincture of myrrh, then closing the orifice of the opening with sandarac and cotton. This treatment was continued for about four weeks, patient visiting the office every third day, and directed to syringe the cavity daily at her home. This was employed with a view to correcting the slight secretions present, and any inflammatory condition of the parts that might be present. After this we used iodine and glycerine as an injection, painting externally with an etherial solution of iodine. At the end of a few weeks we increased the strength of the iodine by dropping the glycerine, employing cotton as a vehicle, saturating it with iodine, nearly full strength, and packing the cyst-pouch, removing every third day. The tumor gradually disappeared under this treatment. The iodine, even when used of considerable strength, causes very little irritation, and yet modifies the secretions and nutrition of the cyst. The iodine treatment was continued until about the middle of May, 1877, when the secretions subsided, there being no more discharge from the cavity, and as the tumor decreased, the frequency and strength of the application was lessened. At this time the patient was dismissed, with directions to keep the alveoli open, and syringe morning and evening with a weak solution of iodine and glycerine.

General Treatment.—This was, as is indicated and appropriate for such cases, of a supporting and tonic kind, with due regard to the regulation of digestion and secretion. We recommend nourishing food to be taken regularly three times a day and frequent exercise in the open air. The patient returned in

August, 1877. Upon examination we found the tumor had entirely disappeared, and with its cure the general tone and health of the system was manifest in a large degree, from the fact that she had gained considerable in weight and spirits, remarking that she was feeling herself again.

P. S.—Since the above report was in preparation I have visited the lady, and she informed me that a few years before the accident she had occasion to complain of general debility, and especially about the time of the accident she was in delicate health, remarking that she had lost her color (general anæmic condition). The hypothesis, we think, would be that the state of the blood in this case had more influence in the causation of the growth of the tumor than we have accorded it in the report. The case is surely one of much interest; hence we have endeavored to get all the information possible concerning its history, so that we might be the more able to study the pathology and etiology in connection with it, and in this respect we have only hinted in a brief way in this report, hoping that others who may be interested in like research may throw some light upon the subject.

Journalistic.

In the *L'Art Dentaire* for May, we find an article by M. Letievant upon "Neurotomy in Neuralgia," in which the writer strongly advocates the operation and urges the propriety of repeating the operation if the neuralgia returns. He says the nerve should be carefully separated from all of the surrounding tissues before it is cut. He records sixteen operations upon twelve different persons, in cases which had resisted all other treatment, and ten were cured. He states that the operation is usually no more dangerous than any insignificant wound.

In the *St. Louis Clinical Record* for May is an *excerpt* from a French medical journal which is well calculated to throw some

doubt upon the alleged efficacy of dialysed iron. Professor Bauchardat says that it is absorbed with difficulty and under the influence of small quantities of alkali, acid, and various substances contained in the food forms an insoluble compound.

The *Dental Register* for April has fifteen pages of address to the graduating class in the Ohio College of Dental Surgery. The address was delivered by A. O. Rawls, D. D. S., and by boiling it down to a point beyond which evaporation can no longer lessen its volume, the concentrated mass is found to be composed of the following proximate principles: 1st, The dental profession ought not to "be swung as a tail to the kite of another profession;" 2nd, that there are too many dental schools; 3rd, that young men should be *selected* for dental students who are of the proper material to work up into dentists; 4th, that students should have proper office instruction.

The next article in this number of the *Register* is by W. C. Duncan, D. D. S., upon "Practical Dentistry." This writer is exceedingly wroth with those who are inclined to speak lightly of mechanical dentistry. He throws himself into the breach with *fixed bayonet* and repels all attacks made upon this department of dentistry with brave words, in fact with a *sarcasm* which is perfectly dreadful, and which must carry terror and dismay into the hearts of all opponents. But hear the dreadful scathing words of this Knight of the Vulcanized Rubber: "The correlation of forces in dentistry are such that no one can be ignored without doing irreparable injury to the whole. In proportion as these forces are evolved by the action of the mind, properly understood and acted on, the more beauty and harmony will reveal itself and in a corresponding degree will the dentist be truly elevated in his own estimation and in that of his fellowmen. Such a man will appear in very marked contrast to those asses in the business who put on the lion's skin, and if they did not attempt to roar might deceive." * * * "The dwarfs who sneer at and would ostracise mechanical dentistry, can congratulate themselves in having a noted and hoary antecedent, for this occurred in the dark ages. * * * Away with the twaddle that operative is superior to mechanical dentistry. * * * A few years ago the majority of dentists

smiled at the idea of vulcanite, so common, cheap, and easily manipulated a material ever taking precedence over the noble metals, gold and platinum. "They have all ceased smiling." We congratulate any journal which is able to furnish two such *precious* articles in one number for the edification of its readers.

The rest of the *Register* is taken up with the transactions of the Mississippi Valley Dental Association.

The *American Journal of Dental Science* gives twenty pages to some articles of the new departists which were published some months ago in other journals, and have been commented upon by us long ago, but it also gives us an address which was delivered before the Alumni Association of the Baltimore College of Dental Surgery, by S. J. Cockerill, D. D. S., President of the Association, which is well written, and which is filled with correct ideas and mostly orthodox doctrines, and not a little sensible advice.

Prof. Hodgkin has an article entitled, "Is the Dental Profession Crowded." After showing that the average of patients to the dentist in this country cannot be more than one thousand, he still comes to the conclusion that there is yet room enough "in the upper stories," or, as he states it: "But to any young man who will first fill his mind with knowledge, as he can best obtain it in some literary institution, and then study dentistry for at least five years, following that course with a graduation at a good medical school, and then start out, he will not be likely to find the position he takes in the profession he has chosen at all crowded." The writer also thinks that the great fault lies in preceptors taking students who are not well prepared by preliminary education, and in not requiring of them a sufficiently long period of pupilage.

Next is an article by Henry E. Beach, D. D. S., of Tennessee, upon, "Professional Hobbyism." He says, "he who has a stereotyped rule by which he is governed, regardless of idiosyncracies, temperament, etc., is a quack in the broadest sense of the word." In a word, the writer advocates a judicious eclecticism in practice, not that eclecticism which exists only in *name*, but the genuine article such as is practiced by every sensible,

capable and honest physician in the medical profession and by every capable and honest practitioner of dentistry.

In an editorial of this *American Journal*, the editor, whilst speaking of the proposed formation of a society of Oral Surgeons, and stating that its membership is to be limited to those who hold medical as well as dental degrees, says, "nor can we, considering the present ease with which medical diplomas are obtained all over the land, see why the addition of M. D. to his titles should give him consideration. "If a dental diploma is a sham," as the *Canada Dental Journal* says, the medical diploma is much more a sham, "and of itself is significant of nothing, save that the holder, perhaps, paid certain fees and possibly heard some lectures." Now, this statement, in regard to medical degrees, is altogether too sweeping, and dental degrees are *not* all a sham. We will not deny but that there are bogus medical and dental diplomas in the market, and that they can be bought by almost anyone who will pay a moderate price for them; in fact, I am of the opinion that dental and medical diplomas have been often sold for a small consideration in this very city, as well as in Philadelphia, and probably other cities throughout the country, and I believe that they have usually been sold to the verriest dregs of the profession, and I have no doubt but that others of the same class will supply themselves from the same source, still I recognize the fact that there are a great many honest medical and dental schools in the country whose graduates honestly earn their degrees.

No system of education has yet been devised to which objections could not be urged, but even if this be true, it is not sufficient reason for condemning all educational enterprises, and throwing away all of the valuable experience heretofore gained, and this would be the legitimate result of a public opinion which would accord with the dental-diploma-sham doctrine of the *Canada Journal* and the medical-diploma-sham doctrine of the *American Journal*.

The members of the profession are, to a certain extent, responsible for the existence of these *bogus* diplomas, as well as for those which are put forth by schools which attempt to put on some of the appearances of respectability, but at the same time, under one pretense and another, grant diplomas without

any proper collegiate instructions, for if the profession were united in denouncing all of these frauds as they deserve to be denounced, and if the journals were fearless in exposing them, much would be gained for the profession. In fact, many important questions are more or less agitating the profession which the journals almost totally ignore, and so far as their influence is concerned in shaping a correct public opinion, they might as well have never existed, and even important scientific discoveries, made by eminent dental practitioners, are never noticed, and their readers kept in ignorance of the progress which is being made in their own ranks at the present day. Is it not time that the journals should shake off their drowsiness and allow themselves to be heard upon the living issues of the day?

Johnson's Miscellany for April, has a reply to Dr. Webb's strictures upon Dr. Wright's article upon, "Gold, a Temporary Fill," which appeared in the *Miscellany* some months since. Though professing to hold to the doctrines of the paper, still he modifies his opinions and ideas so much, and amplifies upon what he calls a temporary filling, to such an extent as to practically abandon his former positions, and comes down to some common sense views upon the relative values of the different filling materials.

Another article in the *Miscellany* is taken from the *Canada Journal of Dental Science*, and is a reply from the latter journal to some strictures made by the *Cosmos* upon a former article of the *Canada Journal*, in which it claims to be the only independent journal on the continent. We had supposed that the little Canuck *Quarterly* was defunct, but are glad to learn that it is alive and kicking as vigorously as ever, in fact, making it quite lively for the *Cosmos*.

Transactions of the First District Dental Society of New York, make up the rest of this number of the *Miscellany*.

Dr. Atkinson reports the removal of a tumor without the use of an anæsthetic of any kind. He took occasion to speak in strong terms against the frequent administration of anæsthetics, and to warn every one against taking the risks there by incurred.

Some very sensible remarks were made by Drs. Latimer and

Mills, especially upon Dental Education. Dr. Mills said, "if I had a son that I wished to bring into the profession, I would give him an education in the schools; then I would give him a medical education, and then put him as a private pupil with a dentist." Dr. Latimer asked, if he would require him to go through a dental college? In answer, Dr. Mills said, "I would give him that advantage. * * * I do think that the failure of to-day is the want of a backbone in medical education. I believe that the dental profession of to-day, if it gave a medical education, would have more backbone about it. We will never be a profession until we do that—until we have a medical foundation."

Microscopy and Histology.

[*All communications for this department should be addressed to Dr. G. V. Black, Jacksonville, Ill.*]

PRACTICAL STUDIES OF THE DEVELOPMENT OF THE DENTAL TISSUES.

Cutting sections of the jaws of the fœtus at different ages, is to be conducted in the manner heretofore described, until the age of six or five and half months of fœtal life is reached, or the time of the commencement of the formation of the enamel and dentine.

At any age younger than this the decalcifying process may be dispensed with as unnecessary. Any of the bones of the face may be cut at or before this time, *without previous softening*, in the same manner as that detailed for the fœtus at birth.

In very young subjects it is all the more important to have them perfectly fresh and to avoid any maceration except that which may be necessary to remove the blood. For this purpose it is necessary to allow the parts to be cut to lie in cold water for twenty-four hours or more until the blood is soaked out. If this be neglected the blood remaining in the parts will stain the

sections and impair their transparency. If the sections are cut by the freezing method they may be soaked out after being cut before being placed in glycerine or alcohol. If, however, the sections are to be cut by the gum arabic process, presently to be described, the previous removal of the blood is imperative as it cannot be done afterward for the reason that the blood-stains become fixed.

In no case should very young specimens be macerated in alcohol before cutting, as it tends to the loosening of the epithelium which will thus be rendered more liable to fall away and destroy the value of the sections. Here we wish especially to retain the epithelial cells filling the primitive dental groove which is well known to be a matter of considerable difficulty, so much so indeed that the older histologists who depended upon hardening in alcohol uniformly lost the epithelium filling this groove, and consequently described it as an open groove, which is now well known to be erroneous. If at any time you wish to remove the epithelial layer perfectly without disturbing the sub-epithelial tissues, macerate the specimen in alcohol for a few weeks. This may be turned to good account in many instances.

We have employed this plan for removing the epithelial layers from injected preparations of the tongue, exposing perfectly the projections of the sub-epithelial structures into the papillæ with their vessels and nerves. Also for drenching the vili of the intestines of their epithelium, for the more perfect exposure of Peyer's patches and the solitary glands and other purposes.

GUM ARABIC METHOD.

The choice of this method is to be made on the following considerations: It always induces a certain amount of shrinkage of the tissues, and is therefore not to be employed when a little shrinkage of tissue would materially mar the appearance of the sections. Judgment as to whether shrinkage will be injurious or not may be easily made. Take for instance any uniform structure, as muscular, fibrous, or glandular tissue; a little shrinkage will not be particularly injurious for the reason that all parts will shrink alike and no deformity of the section will result. If, however, we take the jaws of the fœtus at birth, when we have the soft tissues mingled with bone that will not

shrink, we will have the tissues on the outside of the bone drawn and condensed upon it and the tissue inside the bony cavities drawn away from the bone and massed together. The softer tissues, as the enamel pulps, will condense more than the dental pulps or germ, etc., so that the sections will be ruined by a shrinkage that would not in any way injure sections of the muscles or glands where the tissues throughout are of one consistence.

It therefore happens that in the earlier months of the fœtus, before there are any bony cavities formed, we may do as well or better by this than other methods. The especial point in favor of this method is the fact that it holds and retains every epithelial cell exactly in its place during the process of cutting and the after handling of the section until it is placed upon the slide.

The mode of procedure is as follows: Make a solution of gum arabic in water over a gentle heat, adding gum arabic until it is about as thick as can be poured from one vessel to another. A little carbolic acid should be added to prevent mould from forming. The specimen to be cut being ready a pin is stuck into it in such position as to afford a guide in placing the piece in the section tube; a little lead weight that will sink it is attached and the piece swung in the gum solution by a string. It should remain in the solution until thoroughly saturated, which will require from one to three days, according to the bulk of the piece. It is then removed with as much gum as will adhere to it and placed at once in absolute alcohol. Alcohol does not dissolve gum arabic, but it does abstract the water, which results in the rapid hardening of the whole mass. It should generally remain in the alcohol about the same time as is necessary in the gum arabic solution or until the whole mass is sufficiently hard to cut without dragging before the knife. In large pieces it will be found that the surface becomes very hard before the center hardens sufficiently. This will generally be found to right itself if it be allowed to stand in the investment from twelve to twenty-four hours before cutting. The moisture remaining becomes equalized throughout the mass. For investing pieces thus prepared there is no better material than paraffin. After investment if it be found that the piece is too hard to cut, a little water

may be applied for a few minutes until the surface is softened; then pour a little melted paraffin over it to seal it up, and set it away until this is equalized through the mass. It may also be dried out more by placing in alcohol. It should cut easily and softly without any cracking or breaking. The sections may be handled with impunity, as there is no danger of breaking or disarranging them, if anything like ordinary care is used. They may be placed in alcohol for any length of time before being mounted. They will keep perfectly.

The gum arabic should be dissolved out of the sections prepared by this method before they are mounted, though if the mounting be in glycerine this is not imperative. If the sections are such as may be handled they may be placed in a dish of water or even in pure glycerine and allowed to remain until the gum is dissolved. In case glycerine is used a gentle heat will be required. After the gum is dissolved the sections may be mounted in the same manner heretofore described, or treated as if cut by any other process. In most sections of the fœtal jaws, and others in which displacement is very liable to occur, the gum should be dissolved out on the slide upon which the section is to be mounted so that no after handling will be necessary. This is most readily done by placing the section in position on the slide, and so placing the slide that one end may be gently elevated sufficiently to allow the water to run off without sufficient motion to derange the section. Add the water and let it rest until solution is complete, then very gently raise the end of the slide and drain off the water, after which the mounting may completed in the usual way. The objection to mounting before dissolving out the gum is that during the solution minute bubbles are liable to appear.

For the purpose of studying any tissue these sections are very readily mounted in a solution of gum arabic. All that is necessary is to place a drop of the mucilage on a slide, lay on a section and apply a cover (the lower side of which should be wet with the mucilage). In a very short time the gum will harden sufficiently to allow of their being handled with impunity. This plan of mounting is so convenient that it may with much propriety be adopted in any case where it is desirable to study a great number of sections, the permanent preservation

of which is not especially desired. They are well preserved for several months, but as the drying proceeds the gum *shrinks* and a multitude of cracks presents themselves. This may be delayed for a long time by removing the superabundant gum as soon as sufficiently hard and applying a thorough coat of demar or other cement to prevent further drying.

The gum arabic method is very useful in many cases for free hand section cutting. For this pursose the specimen is pinned to the end of any piece of wood that will serve as a handle to hold it by, and the end with the specimen immersed in the gum solution until saturated and then dried in alcohol. From this preparation the most delicate sections may be cut with a strong knife held in the hand.

A few words might be said as to the positions from which sections of the jaws may be most advantageously cut for displaying the various structures. Thus far we have spoken only of the antero-posterior perpendicular. This position is always among the first to be chosen, no matter what the age of the fœtus. But this applies only to sections of the anterior position of the jaws. For sections displaying the gemrs of the temporary molars, a change of position is required so that we may cut squarely across the jaw. This in the lower jaw will also very clearly show the contents of the inferior dentinal canal, the nerves, artery and vein, and their connection with the tooth germ will be partially shown. A series of sections cut perpendicularly in a direction lengthwise of the jaw through the temporary molars, will give a very complete showing of these connections and at the same time display the germs to advantage with the spaces between them. These should be studied in both positions, taking the cross sections first. The upper jaw should also be cut in the same way.

For displaying the germs of the permanent incisors and their relations to the germs of the milk teeth at any age, the antero-posterior perpendicular is the best position. If it be varied just a little after passing the lateral incisor so that the line of the cut from the anterior to posterior will incline toward the median line, it will generally give better results as the lateral incisor germ will then come more directly in line with the center of the milk tooth. At birth the germs of the permanent incisors will

be found level with, and just posterior to the germs of the milk incisors. They will appear only in a very limited number of the sections, showing the milk tooth germs on account of their smaller size.

In examining the dental groove and the buds making off from it for the formation of the tooth germs, the antero-posterior perpendicular cuts are generally the best, but this only applies to the anterior position of the jaws. For the posterior parts the cuts should be made equally from side to side. These will show the dental groove on both sides of the mouth and of both jaws cross sections of the tongue, nares, etc., giving a very comprehensive study of the parts and their relations.

What we have said of the human fœtus applies with equal force to sections of the jaws of the animals. The positions for cutting are the same and the results are very similar, the point of difference being only those of form and the positions of the epithelial buds and germs. They will often be obtained when the human fœtus is not at hand.

For the study of the development of the germs of the permanent teeth and the absorption of the roots of the milk teeth, the jaws of kittens and puppies answer a most excellent purpose. A litter of kittens, for instance, may be commenced with at birth, and one prepared and examined at birth, another at two weeks old, another at four weeks, and so on until the whole process of development of the germs of the permanent teeth and the absorption of the roots of the milk teeth have been studied. For this purpose the anterior-posterior perpendicular position is best for the incisors. For the molars perpendicular sections lengthwise of the jaw are best, especially any time after the milk teeth are fully in position. In these sections the germs of the permanent teeth will be found between the roots of the milk molars. They make beautiful objects and afford most comprehensive studies of the relations of the parts.

AMERICAN DENTAL ASSOCIATION.

The eighteenth annual session of the American Dental Association will be held at Niagara, Tuesday, August 6, 1878, and continue in session four days.

MARSHALL H. WEBB. *Cor. Sec'y.*

HARRIS DENTAL ASSOCIATION.

At the tenth annual meeting of the Harris Dental Association, of Lancaster, Pa., the following officers were elected to serve for the ensuing year: President—Dr. John G. Moore; Vice President—Dr. E. M. Zell; Recording Secretary—Dr. Wm. N. Amer; Treasurer—Dr. A. F. Herr; Executive Committee—Drs. Samuel Welchens, John M. Colla, and John S. Smith.

CALIFORNIA STATE DENTAL ASSOCIATION.

The California State Dental Association held its ninth annual session at the Palace Hotel, San Francisco, commencing Tuesday, June 4th, and continuing four days. Dr. Wm. C. Kingsbury, President, Santa Clara, presiding.

After the general routine of business was gone through with, the President read his annual address, and was followed by Dr.

E. S. Lane, who read a paper entitled "The Best Methods and Materials for Treating and Filling Children's Teeth."

Dr. J. S. Hulburt, of Springfield, Mass., made a few remarks congratulating the Association upon its perfection and success.

Dr. W. H. Robinson read a paper on "The Treatment of Six-year-old Molars."

Dr. McLain, of San Rafael, read a voluntary and admirable essay entitled "Therapeutical Treatment of the Dental Pulp."

Dr. F. A. Brewer (formerly of Chillicothe, Mo.,) read an essay on "The Conservation of the Dental Pulp."

In the evening of the second day the Association listened to a lecture by Dr. J. H. Wythe, of the Medical College of the Pacific.

Dr. F. A. Brewer read a paper on "Ignorant Practitioners of Dentistry." He claimed that more rigorous regulations were required to protect the rights of the profession.

Dr. Robinson read an essay on "Dental Criticism," rebuking the public for its unjust animadversions, and also dwelling on the uncharitable criticisms of one dentist of another dentist's work.

The following officers were elected to serve the ensuing year:

President, Dr. S. W. Dennis, San Francisco; Vice-president, Dr. J. S. Crowford, Los Angelos; Rec. Secretary, Dr. S. E. Goe, San Francisco; Cor. Secretary, Dr. H. E. Knox, San Francisco; Treasurer, Dr. J. J. Birge, San Francisco; Librarian, Dr. Wm. Dutch, San Francisco.

It was resolved to hold the next annual meeting in San Francisco, on the second Tuesday in May, 1879.

RESOLUTIONS PASSED AT SWEET SPRINGS BY THE THE MISSOURI STATE DENTAL ASSOCIATION.

WHEREAS, The Missouri State Dental Association has been regally entertained as invited guests by the Sweet Springs Company during its present annual session; and

WHEREAS, We regard the waters of the "Saratoga of the

West," as of great value to the invalid, possessing medicinal properties which render them eminently superior as a correction for indigestion and dyspepsia, and the place by its pleasant surroundings fitted for a resort for health and recreation. Therefore

Resolved, That the thanks of this Association are hereby tendered the Sweet Springs Company for their generous and hospitable entertainment, and especially to Messrs. Lester Marmaduke and Joseph Huskins for their polite and courteous attention during our stay, making this meeting an occasion to which we shall ever recur with pleasure.

Resolved, That this Association hold its next annual meeting at "Sweet Springs," and that we, the attendant members, will use our influence to induce our friends and professional brethern to join with us in a grand reunion here in June, 1879.

Resolved, That a copy of these Preambles and Resolutions be furnished the Sweet Springs Company, and a copy sent to the Journals for pulication.

JNO. C. MCCOY,
JAS. A. PRICE, } Committee.
A. H. FULLER,

CROWDED OUT.

The report of the Missouri State Dental Association being crowded out will appear in our next issue.

CELLULOID.

We have been using celluloid ever since its introduction, as a base for artificial teeth, with varying success, and from time to time have given our readers the results of our experience with it through the medium of THE JOURNAL. Have used oil, sperm-

aciti, water, and the dry heat in forming plates, and as we have before stated, have been better pleased with the results of the dry heat process than either of the other means used. We have recently been testing Dr. Robie's method of working this material. In this process the celluloid is cut into small pieces and put into a pump attached to the flask, by which it is forced into mould. In the use of this process the mould is never injured nor the blocks broken or displaced, and if properly done there will be no defects in the plate, the material always closing well up around the pins. The plate also seems to be harder and more thoroughly condensed than by any other process we have used. So far as we have tried it we are well pleased with the result.

It requires a little more time and some more labor than is necessary in the dry heat process, but the advantages it seems to possess over any other method, more than balances the disadvantages. We shall be pleased to have any of our confrés in the city take the apparatus we have and make a trial of the Robie pump. E.

IN MEMORIAM.

TO THE OFFICERS AND MEMBERS OF MISSOURI STATE DENTAL ASSOCIATION.

We, your committee, appointed to draft resolutions expressive of the sense of this Association on the death of Dr. C. W. Rivers, would most respectfully offer the following as our report, viz:

Since our last meeting this Association has sustained an irreparable loss, by the death of Dr. C. W. Rivers, who, after a long, lingering and painful illness, departed this life on the 16th day of September, 1877, in Atlanta, Ga. Dr. Rivers was one of the first, and remained a faithful member of this Association until the day of his death. His wise counsel and genial manner will be most sadly missed. He was a man who loved his profession and did much to elevate its standard, and was ever ready to lend

a helping hand to his professional brothers. He was one of the first trustees of the Missouri Dental College, and at his death still a member of said board. At one time he was Professor of Operative Dentistry and Dean of the Faculty of that institution. He leaves a wife and four children to mourn his loss. Therefore, be it

Resolved, That in the death of Dr. C. W. Rivers this Assotion has lost one of its oldest and most faithful members; the church of which he was a member, a most exemplary christian; his wife and children a kind, devoted and loving husband and father. While it is not in our power to do or say anything to soothe their sorrowing hearts, we do most earnestly tender to them the heartfelt sympathies of this Association, in this, their most said affliction.

Resolved, That the foregoing be spread upon the records of this Association, and the MISSOURI DENTAL JOURNAL be requested to publish same, and the Secretary instructed to forwrrd a copy to the wife of our lamented brother.

JAMES A. PRICE,
D. J. McMILLAN, } Committee.
L. O. ELLIS,

Bibliographical.

THE ADVANTAGES AND ACCIDENTS OF ARTIFICIAL ANAESTHESIA. By LAWRENCE TURNHULL, M. D.

This is a work of 210 pages which has recently been published by Lindsay & Blakiston, of Philadelphia. It is well printed and illustrated, with paper cover, and presents a very respectable appearance. The work gives a description of the most available agents used in producing anæsthesia, chemical tests as to their purity, best methods of administration, and relative mortality from the different agents employed, and a brief history of the discovery of artificial anæsthesia.

A large amount of valuable information is contained in this little work which will well repay the student of medicine to carefully study and digest. The conclusions of the author are

for the most part legitimately drawn, contrasting strongly with the opinions of Sansom, John Snow, B. W. Richardson, and others, who concluded that nitrous oxyde gas produced anaesthesia simply by depriving the lungs of oxygen, and that anaesthesia was nothing more or less than a veritable asphyxia. The experiments by which these gentlemen arrived at their conclusions, as regards the action of nitrous oxide, remind us strongly of some of the so called experiments of the *Experimental Club*, or of the alchemists who would turn the base metals into *stannous gold*.

As to its history of the *discovery* of anaesthesia it is only necessary to state, that it takes its cue from Dr. Bigelow's stump speech upon this subject, which was published some years ago in the *Boston Medical and Surgical Journal*, and which was intended to act as a narcotic upon the somewhat sensitive Boston conscience which at that time was exhibiting some signs of remorse at having permitted the erection of a monument in that city to the memory of Morton, which they could not but feel was intended to rob Wells of the glory which, by right, was doubtless his. Having warned our readers against imbibing this heresy, we can cordially commend the work to them.

FACIAL NEURALGIA AND THE VESERALGIA. THEIR DIAGNOSIS AND TREATMENT. By J. MARTINE KERSHAW, M. D., St. Louis.

This interesting and instructive little monograph is the first of a series of eight parts, on the Diseases of the Brain and Nervous System, to be issued during the present year. Each part will cantain from 50 to 60 pages, each issue complete in itself.

Books and Pamphlets Received.

The Value of Extension in the treatment of the Femur. By JOHN T. HODGEN, M. D., Professor of Surgical Anatomy, Fractures and Dislocations, in the St. Louis Medical College. (Reprinted from the *St. Louis Medical and Surgical Journal*, April, 1878.

First Annual Announcement of the Dental Department of the University of Pennsylvania, 1878-79.

The Herald of Health. A Manual of Practical Hygiene. A Guide to Health. E. W. Gray, Editor, Bloomington, Ill.

The Dental News, a Monthly Sheet devoted to Practical Dentistry. L. P. Wagoner, Editor and Publisher, Knightstown, Indiana.

The Vest-Pocket Anatomist. By C. Henri Leonard, A. M., M. D. Enlarged edition (4th thousand); paper, 50 cents. Detroit, Michigan.

Carbolic Acid Injections in the Treatment of Piles—Radical Cures. By A. B. Cook, A. M., M. D. Reprinted from the *American Medical Bi-weekly*, Feb. 16, 1878. Louisville.

Zahnarzlicher Almanach, 1878. A directory containing the names of the practicing dentists in the Kingdom of Germany and Austrian-Hungary. By Adolf Petermann. Frankfort, A. M.

The Twenty-Third Annual Announcement of the Pennsylvania College of Dental Surgery, Philadelphia. Session for 1878-79. Dr. C. N. Pierce, Dean, 1617 Green Street, Philadelphia.

Transactions of the Ohio State Dental Society. Twelfth Annual Meeting. Held in Columbus, December, 1877. Published by order of the Society. Ransome & Randolph, Publishers, Toledo, Ohio.

Is Modern Education Exerting an Evil Influence upon the Eyesight of our Children? By A. W. Calhoun, M. D., Professor of Diseases of the Eye and Ear in the Atlanta Medical College. (Reprint from the *Atlanta Medical and Surgical Journal.*)

The Advantages and Accidents of Artificial Anæsthesia, being a Manual of Anæsthetic Agents and their Modes of Administration, considering their relative risks, tests of purity, treatment of asphyxia, spasm of the glottis, syncope, etc. By Laurence Turnbull, M. D. Landsay & Blakiston, Philadelphia.

Scraps, Notes and Queries.

QUERY.—Can any one tell us when and by whom sulphuric acid was first used in the treatment of necrosis?

AMALGAM HAS GOT HIM AT LAST.—Prof. J. Foster Flagg, an eminent dentist of Philadelphia, has given up the use of gold in filling teeth. He finds, after twenty years experience, that a mixture of gold, silver and tin is much more useful for arresting decay.—*St. Louis Evening Post.*

GLYCERINE AS A LUBRICANT.—A French journal, *Le Temturier Pratique*, is our authority for saying that glycerine is one of the best lubricants for machinery, especially when exposed to the air and to changes of temperature. It neither thickens nor turns rancid, neither congeals in winter nor dries up in summer. If prefered, it may be mixed with half its weight of olive oil. It does not attack metals, as many oils do.

CAMPHOR-CHLORAL.—Mr. W. T. Toucher recommends the following formula for a camphor-chloral liniment, which has a powerful antineuralgic application: Chloral-hydrate and camphor, of each one ounce; glycerine, six ounces; powder the camphor, using as usual a few drops of rectified spirit; then mix with the chloral, and allow to stand in a mortar until the mixture becomes liquid. Having poured this into a bottle, add the glycerine, and shake.—*London Med. Record.*

SPECIMEN OF POPULAR INFORMATION.—The roots of teeth, like all bone or osseous tissue are covered with a periosteum or membrane; this membrane covers the outside of the root and passes into the inside at the point at which the nerve enters and lines the nerve cavity. This membrane provides the tooth with nourishment. When we destroy the nerve, we necessarily destroy this membrane on the inside of the root; but we only wish to destroy the nerve down to the point of the root, at which place it enters, and, by using care, we destroy this membrane down that far, and the membrane outside the root is left, and the tooth will have this to support it and will still be a living body, and not dead, as is claimed by some, although it is not so highly organized as formerly.—*Falls City Dental Journal.*

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THE PRIZE ESSAY ON THE PATHOLOGY OF DENTAL CARIES.

BY MR W. K. BRIDGMAN.

[CONTINUED FROM LAST MONTH.]

39. The circulation of the albuminous fluid out of which they are formed is due to the vitality of the vessels, and their connection with the general vitalization of the organism; but its being exuded when new substance is about to be formed is owing to the electrical condition of the parts, by which it is not only abstracted when it is wanted, but is also disposed of under certain fixed and definite laws, in the special form required.

40. Having thus traced out the electrical organization of the peripheral battery of the system, which includes the dentine as part of it, and having also shown the "progressive decomposition" of the enamel and dentine to be due to local electro-voltaic action, it remains to be seen under what circumstances the earlier stages of decay have their origin, and how far they may

be likely to be affected by the secretions of the mouth or other adventitious circumstances.

41. It is one of the laws of nature, that, in organic matter in a moist state, stagnation leads to a change. In all living forms a special organization is provided for the fluids which are required in growth to be kept in constant motion. When this organized structure is either bruised, broken down, or otherwise injured, so as to prevent the capillary action by which the moisture is passed on, the injured part is thus shut off from the circulation, and, according as it may contain little or much moisture, in time becomes decomposed and rotten.

42. In the organization of the tooth, the soft fibrils extend to the enamel, and sometimes into it; and as we know the enamel to be capable of absorbing moisture after being suffered to dry, we have a right to infer that it, as well as the other coverings of the cutis, is capable of giving off moisture in the same way as may be traced in the insensible perspiration of the skin; and, in fact, we have no reason to doubt this when moisture may be collected readily from over the finger nails, and therefore may take this as a clue to some of the more obscure conditions predisposing to the commencement of decay.

43. In mouths imbued with thick and glairy secretions of mucus, it is well known that the gums are generally less healthy, and the teeth more prone to decay and more rapid in their decaying, than where the saliva is less viscid. That this should be the case would be inferred from the analogous effects upon the human system generally under corresponding conditions; when placed in an atmosphere so saturated with moisture that the insensible perspiration is unable to escape, sickness and disease are certain to result. In Fig. 12, plate 1, we have a good illustration of the effects of stagnant moisture upon a denuded surface of dentine. On the lower face of the notch, which from its having been on a level with and parallel to the line of the gums, would have been kept constantly immersed in the saliva, cremacausis and decay have taken place; while on the upper face, the surface inclined downwards and free from friction, still retains its polish and is perfectly free from discoloration.*

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*The immediate cause of the production of these notches, as well as the

44. The condition of dentine placed in the mouth *artificially*, corresponds fully with the preceding case; where friction keeps the part free from stagnant moisture, its homogeneity is preserved; but where moisture is allowed to become stagnant, a change soon occurs; the part thus soddened with moisture becomes a prey to the local action of the saliva, which has been shown to be a powerful electrolytic destroyer of dentine.* It is well known that where an artificial denture of ivory is acted upon by friction in the mouth, its polish is preserved, although other parts become decayed; but these polished portions after a time mostly become dark and discolored; the retention of the polish is most confirmatory evidence of the entire absence of all acid reaction upon the part from any acidity of saliva, and proves the change most indisputably to be a prior occurrence to the production of the acid, and "from the fact that, points of action having once been established, the corrosion is increased by the effects itself produces" (Sec. 30). The negative points thus established soon set up sufficient local action to decompose both the dentine and the saliva, leaving the softened tissue—the decalcified membranous matrix of the dentine—to extend its action by its own effects. That it is capable of doing this, and that the negative condition of the element first giving rise to decay is continued in the same state as the decay proceeds, is proved by the following experiment: A molar tooth, which had lost about one-half its crown by decay, was

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denuded portions of the facial surfaces and edges of the incisor teeth, has never yet been satisfactorily explained. In Figs. 13 and 14, a portion of a sound and healthy tooth has been electro-voltaically acted upon partially so as to leave an indentation with the peculiar sharp edge which is a characteristic feature in these occurrences. It has also left a degree of polish very different from what is produced by the reaction of an acid in the ordinary way, thus showing a strong ground for attributing the natural occurrence to this same electro-voltaic action, as effected by the positive surface of epithelium of the lips in contact with them, it being the conduct of a positive pole to transfer the alkaline matter to the negative layer.

B, Fig. 11, plate 1, is one part of a divided molar, showing forty-eight hours' decalcification in saliva. The positive pole was made to rest on the edge of the original decay, so as to produce its extension: and to what extent this has been effected will be seen by comparing the two portions, *A* and *B*.

sawn through the middle, as near as possible, into two equal parts. One of these (A, Fig. 10, plate 1,) remains as cut; the other (C, Fig. 10, plate 1) has been 24 hours under action in saliva. The positive pole was placed at *p*, the negative at *n*. Had the crown of the tooth been in a homogeneous state, the decalcification would have extended across the upper or positive half of the tooth, as it has done in Figs. 9 and 15, plate 1; but instead of this, the surface of the cavity has become lined with concretions of lime removed from the decalcified dentine by the side of it. This is conclusive proof that the surface upon which the lime rests is *electro*-negative. Were it otherwise it could not have been so deposited; its electro-negative condition has preserved it, in the same manner as did the tartar in Fig. 5, plate 1. We have also in the specimen B, (Fig. 10, plate 1,) a very intelligible explanation of the accumulation of tartar upon the *necks* of the teeth. The crown of the tooth being analogous to the outer layers of the skin, is consequently electro-*positive*, a fact which is proved by the occurrence of acid within its substance; but the fang of the tooth, from its connection with the cutis, through the vessels of the periosteum, is electro-*negative*; and hence, when any decomposition may be going on which produces a supply of the alkaline matter, it is attracted to the exposed portion of the negative under the free edge of the gum as a natural consequence of its condition.* In Fig. 11, plate 1, the positive pole was placed on the edge of the pulp-cavity; consequently the power of the battery overcame the more feeble power of the carbon and set up positive action in the two cavities, the pulp-cavity and the carious cavity; but in Fig. 10, plate 1, the pole resting in the center of the sound dentine was sufficiently distant to be unable to overcome the negative tendency of the carious cavity; and hence the latter became the recipient of the lime, as the most intensified negative part of the

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*The author has always felt assured of the accumulation of tartar upon the necks of teeth being due to something more than simple deposit of an ordinary precipitate from the saliva; because the mere lodgment alone would not in preference take place around the necks of the teeth and upon upright surfaces, and attain its great degree of hardness, without some attractive force compelling its cohering and its attachment.

action.* Thus it is by the surface of a carious spot retaining its electro-negative state and increasing its area, that it becomes the extender of the mischief itself produces.

45. It will have been seen that electro-chemical decomposition depends very greatly for its amount and rapidity of action upon the condition of the electrolyte or fluid element of the series; and as the state of the fluids in the system are known to vary very much in health as well as disease, and to be considerably affected by various medicaments taken internally, this difference at different times is abundantly sufficient to account for the tendency to decay at one time more than another without any very apparent cause.

46. It has been shown that the arrangement of the several layers of the skin, and the several layers of the tooth—the enamel and dentine (as one) and the pulp are in opposite electrical states, and correspond in disposition and effects with a galvanic series, and that the formation of dentine as a physical result derived from its action is amply borne out by experiment; hence there can be little question as to other consequences arising from the same arrangement, "for no voltaic battery has as yet been constructed in which the chemical action is only that of combination;" "decomposition is always included, and is, I believe," says Professor Faraday, "an essential chemical part" (858); and thus we may very justly attribute the decomposing effects in decay to the same cause.

47. In endeavoring to illustrate this subject with a series of results which as near as possible should correspond with the natural occurrences in the mouth, a number of new and highly interesting facts have been pointed out; and as Sir Humphrey Davy remarks, "Concerning the publication of novel facts there can be but one judgment, for facts are independent of fashion, taste, and caprice, and are subject to no code of criticism; they are more useful, perhaps, even when they contradict

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* In the same manner that the fang of a tooth sometimes has its electrical state reversed from the negative to the positive, so the enamel, when active decay is taking place, often becomes negative and receives a coating of tartar up to the very edge of the cavity; a state which protects the enamel from being acted upon, and causes it to become undermined, as in specimen Fig. 1, plate 1.

than when they support received doctrines, for our theories are only imperfect approximations to the real knowledge of things; and in physical research, doubt is usually of excellent effect, for it is a principal motive for new labors, and leads continually to the development of truth."

APPENDICES.

APPENDIX A.—NON-VITALITY OF DENTINE.

In what does vitality consist? If we take an egg, a nut or a seed, and place it under the particular circumstances required for enabling its powers of vitality to become manifest, we obtain by such means a special result, in the growth and development of a living organism. But if we break up the egg, split open the nut, or crush the seed, although every atom of their respective contents may be present, their power of growth will have ceased to exist. They will have lost their vitality.

If we take a pip from an orange, a lemon, or an apple, each one contains within itself that which enables it to grow. It is the seat of life. It possesses "vitality." But if we take the cells from the pulp, or a slice from the rind, although each one is equally a product of vitality, we shall obtain *no* development of a plant by their growth, simply because they were never intended to grow, and hence were never endowed with "vitality."

We may take a cutting, a bud, or in some cases a leaf, or even part of a leaf, from a plant, and each one can be made to develop itself into a living and growing individual, identical with its parent form; but split off the bark from the cutting, break asunder the bud, or tear open the leaf, and the power to grow ceases with the separation of the parts. All that has been destroyed has been the arrangement of the substance which constituted its condition of vitality.

If we take for a cutting a portion of the stem of a rose, it is indispensable that it should contain a bud or "eye," because the bud or eye alone possesses the condition of vitality essential to its growth, the stem being only an accessory and unessential part of the arrangement for growing; it, therefore, is not endowed with vitality. The same may be said of the skin. In all rhinoplastic operations, it is necessary to include with the transplanted

flap a portion of the cutis, because the vessels of this part alone contain the essentials of growth. There is, however, one other condition necessary to success; which is, that the vessels of the transplanted portion must remain, or be placed in connection with the circulating fluids of the system. Their vitality is not inherent in the vessels themselves, but depends upon their forming a portion of the general vitalization of the organs; and hence the circulation of the blood within them is one of the conditions constituting their vitality. What we are to understand by "vitality," then, is the being possessed of that special arrangement of parts, which, out of unorganized matter elaborated in the system leads to the development of organized forms and the powers and functions of life.

In this respect the cuticle and basement membrane, independently of the vessels of the cutis, have no power of organizing fresh material; while stripped of their coverings, the cutis, or true skin, is enabled to repair the deficiency, by organizing for itself a new formation in the place of the part removed. Here, then, we have the cuticle evidently subordinate to and resulting from the vitalized arrangement of the capillaries of the cutis; and as the vitalized organization of the system has need of non-vitalized adjuncts to enable it to carry out the special duty of the different functions of the vital organism, it thus provides the bones, muscles, ligaments, tendons, membranes, etc., which serve for its aid and protection.

We thus have in the living being two distinct conditions of matter; the one vitalized and essential to the life of the part, the other non-vitalized and subordinate or accessory to the former. These, however, both depend for their continuance in existence on progression or constant motion of the fluids they contain; otherwise stagnation in contact with the air leads to a change which develops one or more of the physical forces by the decomposition or decay it produces.

In addition to the continual passage of moisture through the substance of organic products in connection with the living organism, most of these bodies are perpetually undergoing a renovation, or replacement by new, as the old portions are either taken up again or discarded from the system. Among the principal exceptions to the latter rule are the enamel and the den-

tine; the former being *never* replaced, and the latter but partially so, and then only by an unorganized and structureless mass.

Albumen, which enters largely into all organic forms, is composed of elements put together in such a manner as has never been effected by the hand of man. It is, therefore, termed "vital," and being a vital substance, the force which holds it together is designated the vital force. It has been supposed that this vital force, which has been instrumental in the production of all organic forms, is capable of migrating out of one form into another; that vital force is given out in decaying wood, and becomes the life of the fungus which grows upon it. Prof. Grove has shown us that all the physical forces, "are correlative, or have a reciprocal dependence; each one producing *other* forms, but *merging itself*, as the force it produces becomes developed." Therefore in the decaying wood we have other forces, as heat, light, chemical affinity, etc., appearing in lieu of it; it being an irresistible inference, that a force cannot originate otherwise than by generation from some antecedent force or forces; and heat and light, in combination with moisture, are known to be the most powerful abettors of life and growth. Organic matter exerts no influence upon other forms of growth, until the *chemical* force begins to set free the elements formerly held together by the *vital* force; and as all cryptogamic as well as other vegetation is known to arise from spores or seeds, and these spores containing within themselves the germ or condition of birth, are teeming in every direction, wanting only the presence of moisture to start them into growth, together with a suitable nidus, which is here found in the decaying organic matter. The fact of seeds germinating in pure sand and water proves them not to be dependent on receiving vital force from other sources. Are we not, therefore, justified in regarding dentine as a vital body but not possessed of vitality? As a substance composed of elements united by the force which is understood as the vital, but acquiring its physical condition of form and density through a physical force originating from the vitalization of the pulp and its vessels.

APPENDIX B.—PHYSICAL NATURE OF DENTINE, AND ELECTRO-FORMATION OF BONE SUBSTANCE.

The persevering efforts that have been made to endeavor to

interpret the formation of dentine by the cell-development theory, and the persisting in this course to the exclusion of seeking in other directions, has led to this being less understood than almost any other substance to be found in the animal system.

That cell-growth is concerned in the formation of the tooth is unquestionably true, but its action is limited to the production of the mould and its matrix or cone, upon which the dentine is deposited. The manner in which dentine commences and continues to form renders it necessary that some means should be provided by nature that the outer layer, which is the first to form, should be of the exact size and form of the future dentinal crown of the tooth. This is accomplished by the tooth papilla attaining, by cell-growth, a soft, pulpy mass of the dimensions required. But with the attainment of this, the *vital* part of the process to a certain extent terminates; the *vital* force, no longer required for assimilating growth, merges into the electrical, and, hence, by the action of a *physical* force, completes the transformation, or rather replacement, of the soft by its hard and stony successor. The pulp in its soft state is still covered with basement membrane and epithelium, but as the formation of these substances is no longer required to be continued, the albuminous material which went to form them now begins to accumulate at the centers of ossification to form a basis of future dentine.

Soon after this has commenced, it becomes tenanted by minute granular bodies, which, continuing to increase in size and quantity ultimately assume the compact and dense form of bony deposit. The granular bodies constituting the hardening element of bone, at one time were looked upon as "solidified cell-contents;" but the true character of these formations has been fully demonstrated by Mr. George Rainey* as being nothing more than a peculiar form of crystalization of the salts of lime, due to the viscidity of the medium in which they are formed.

These "artificial calculi," as they have been styled by their discoverer, were obtained in great abundance from a viscid solution of gum acacia, but they were entirely isolated specimens in their most perfect form.

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* On the Mode of Formation, etc. G. Rainey, M. R. C. S.

By means of electricity the author has succeeded, not only in producing them in a very much shorter period of time, but also in having a membranous matrix out of albumen, having within it these deposits in a definite layer, coalescing and aggregating together, and closely approaching the appearance presented at the edge of a natural bone in its early stage of formation.

In electro-voltaic decalcification of bone, the salts of lime pass *from the positive to the negative pole.*

Under the action of electricity, albumen is coagulated and rendered insoluble;* but there is more than this,—it assumes a definite shape and structure, very much after the manner of iron filings between the two poles of a magnet.

Around the negative pole is formed a cell-like sphere of highly transparent and glassy-looking substance (Fig. 16) while at the positive pole the mass collected is granular and somewhat opaque; but intermediate, a wall of substance forms and spreads out right and left so as to separate the contents of the vessel into distinct portions.

According to the law enunciated by Mr. Rainey, it was easy to foresee, that if viscidity were the true cause of the salts of lime taking the globular character instead of the usual form, by electro-decalcifying bone in a viscid solution, the salts of lime would be arrested in their passage from one pole to the other, and take up their position within the coagulated albumen as a matrix. This they have been found to do, not indiscriminately, however, but aggregating together in a layer in the interior of the substance, forming the septum or diaphragm C across the vessel and between the two halves of its contents.

Fig. 17 represents a vertical section in the line of the two poles, or at right angles to the diaphragm, showing also a free border of unappropriated material on either side.

Fig. 18, is a square vessel, actual size, in which the experiment was made. Fig. 19 is a vertical section of Fig. 18 from D to D.

G, Fig. 19, is a piece of walrus ivory placed at the bottom of the vessel to furnish the lime transferred to the matrix C.

E is the negative wire and F the positive. The shaded por-

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*Brande's Manual of Chemistry."

tion of G shows the extent to which the decalcification proceeded. Fig. 17 is a minute portion of C in the line DD. In mounting it has been pressed out, so that the line has become crushed down and spread out. Fig 20 is a small portion further enlarged. The scale below each represents the hundreth of an inch; Figs. 17 and 20 having been traced with the camera.

Fig. 20 is a more highly magnified portion of the edge of the line, showing the globules coalescing into a more solid form.

Fig. 7, Plate 2, shows a portion of the same, but with a piece of litmus text-paper applied to it while soft, showing the acid and alkaline condition of the opposite sides of the structure, while this complete similarity of proceedings and corresponding nature of the results between the artificial production of what may be termed bone-substance, and the natural process in the development of the tooth; and as this occupies in nature the same relative position in the peripheral battery of the system that it is found to do when produced artificially, there can be no hesitation in accepting them as being both produced by the same physical force. The peculiar structures which have hitherto caused so much perplexity as supposed "formative membranes," are here shown to consist of nothing more than a *free and unconsolidated border of the membranous material.* The cause of their separating readily as apparent membranes under the action of an acid or in supparation, may be ascribed to a similar effect of the line of consolidated globules, as the line of perforations produces in a sheet of postage stamps. There are various other minutiæ traceable in the development of the natural organ, which may be equally illustrated by the same means; but sufficient has been said to afford an ample demonstration of the fact, that the production of dentine is due to a physical force developed and fed by the vitality of the vessels in its pulp. What I have here sought to establish is that *certain parts* only of the living organism are endowed with "vitality," or with that condition and arrangement of parts necessary to the accumulation and organism of organic material into organic forms; and that as these organic bodies are then of themselves not required for, nor capable of organizing, other material, they are not endowned with vitality, but possess only physical properties essential only for maintaining the persistence of organic fabric. That these organic forms

contain a force keeping them in combination, which we designate *vital* because it is not producible in any other way than as the result of life and growth; and that as all the physical forces require some antecedent force, no force being able to originate itself, we have the vital force as the starting-point or great store house from which the physical forces emanate. And that as we have this vital force in the system correlated into motion in some cases, into heat and chemical action in others, we have it also correlated as well into electricity, which has been shown to contribute certain definite characters and organic material corresponding in many parts with natural products; and hence it has been assumed with a very fair show of reason, that as the *other* physical forces are absolutely necessary to the *production* of animal forms, electricity should also be employed.

APPENDIX C.—STRUCTURE OF THE ENAMEL.

The structure of the enamel has been described by all physiological writers as of a *crystalline* character, with the crystals prismatic and placed endwise in the pulp, and as being formed through the instrumentality of what has been termed the "enamel organ," but beyond this, no further advance appears to have been made in tracing out the laws of its formation. Now, it can be shown that the entire coating of enamel upon a human tooth is arranged as a portion of one of the globular crystals of lime, such as are formed in developing dentine.

Fig. 21 is from one of the artificial calculi given by Mr Rainey at page 12, fig. 4*a*.

Fig. 22 shows a circle filled up in the same manner with lines radiating from the centre to the circumference, and corresponding in this respect with Fig. 21. The thin line drawn across will show an apparent section with the supposed enamel fibres, as seen in nature. If a pin be passed through the centre of the radiating lines, the tracing might be turned in any direction, while the radiating lines will retain their relative position, showing the centre of the enamel lines to fall somewhere near the centre of the crown of the tooth. In a multicuspid tooth a very slight variation will be found in the action, being a tendency to produce several different centres and giving rise to a somewhat compound crystal, with as many short lines instead of a single

point for its centre. To obtain this coating of enamel is one of the main objects of the tooth papilla sinking down into the capsule within the jaw-bone. When the dentinal papilla has grown to its full size, the capsule surrounding it forms a casing with the epithelium of the two surfaces in contact; therefore the inside of the capsule must correspond in shape with the outside form of the papilla; and hence, when the capsule is distended by the plastic mass of the forthcoming enamel, we have a mould which in some measure determines the shape and thickness of the future layer.

The fluid or plasma of which the enamel is formed, "resembles in consistence the albumen of a common fowl's egg, and like it will run off an inclined surface. It has a sticky feel to the fingers, like a strong solution of gelatine."* We have thus the viscid medium required for giving rise to the globular form of the crystals, while the reason that one large crystal forms instead of a number of small ones, is evidently due to the attractive force of the one or more negative centres of the pulp overcoming the tendency of any weaker centres within the plastic mass itself; and being moulded to the interior of the capsule, is thus prevented assuming its own exterior globular shape, but is made to take that of its mould.

APPENDIX D.—ABNORMAL ENAMEL.

"The direction taken by the enamel fibre is, for the most part, vertical to the surface of the dentine upon which it rests; those, therefore, which proceed from the flat surface of the crown will rise vertically, while those from the lateral surface of the tooth will be horizontal. The ends of the enamel fibres are received into the shallow hexagonal depressions of the coronal surface of the dentine, from whence, in their course, they describe frequent curves." Such is the description given by Mr. Tomes in his Lectures, page 52; of which the former portion relates to its *normal* state, while the latter refers to an abnormal condition produced by a disturbing cause during the period of its formation. The dentinal beginning appears on the pulp, spreads over the surface of the latter, forming a thin shell down to the junction with the lower edge of the capsule. On its outer

* Tome's Lectures.

surface rests the basement membrane, upon which the enamel crystals are arranged.

Fig. 9, Plate 1, has a portion of the transverse septum left attached to show its position or outer surface covered over with pit-like indentations, and this surface corresponds with the positive or outer surface of the dentine. When this shell of dentine has formed upon the pulp, prior to any of the plastic mass of the enamel having become fully crystalized and adherent, the radial lines of the enamel will be straight or normal, as in Fig. 23; but when the *crystalization has commenced before* the dentine centres of ossification are complete, or the pulps fully matured, the cusps of dentine, as they become perfected, rise up into the semi-plastic mass of crystalizing enamel and force or drag the adherent crystals with them in their upward course. This action will be clearly seen to have taken place, by the accompanying sketch, Fig. 24; the two cusps having produced their disturbing effect most upon the apex, but less and less downward towards the neck of the tooth.

If on the completion of the dentinal crown and its commencing to rise by the growth of its fang, the whole of the enamel be sufficiently "set" to be elevated with it entire, the outer portion of the enamel attains a normal direction; otherwise a fresh set of curves will be produced on this part, rendering it also abnormal.

It is but reasonable to conclude that any such interference with the half-set crystallization must tend to weaken its attachment to the surface of the dentine, and render the enamel less homogeneous; and not only is there thus a tendency for the cohesion among its own particlss to be lessened, but a curved line in the place of a straight one presents a physical defect, which, on the ordinary principles of mechanics, must offer a weaker resistance to outward pressure than a straight one; and hence, this description of enamel will necessarily be weaker in resisting the effects of lateral pressure than the normal arrangement. The examination of a large number of teeth showing incipient decay has led to the conclusion that the condition of the enamel in this respect materially influences the results of the crushing effects of lateral pressure, and that the more vitreous and dense, that is, the more perfect and normal, the crystallization of the

enamel, the less does it appear to be the subject of injury.

SUMMARY OF THE PRECEDING FACTS AND CONCLUSIONS.

1. That dentine can have no claim to be considered as possessing "vitality," but that it is simply a vital product in an organic form.

2. That the vessels of the pulp—namely, the nerve, artery, veins and their capillaries, together with the vessels from the periosteum, are the only parts of the tooth endowed with "vitality."

3. That the pulp vessels, together with the dentine and its enamel, in conjunction with the albuminous fluid with which they are moistened, form an electro-voltaic series, and are a portion of the peripheral battery of this system.

4. That the result of such an electro-voltaic arrangement is to withdraw albuminous material from the blood circulating in the vessels of the pulp, and to effect its consolidation according to certain fixed laws.

5. That the formation of dentine is due to this electro-voltaic action. The growth of the dental papilla to the size and form of the future tooth being purely an act of vitality, the subsequent deposit of membranous matrix, together with its becoming filled up with the salts of lime, are clearly demonstrated, by the artificial production of bone substance, to be due to a physical or electro-voltaic action.

6. That any seemingness of vitality in the dentine may be ascribed to its being imbued with albuminous fluid, and constituting the positive elements of a galvanic series, of which the negative is supplied by the negative vessels of the vital pulp.

7. That local action in an electro-positive element constitutes the decalcifying and acidifying process in decay.

8. That as some forms of carbon are among the most powerful electro-negative bodies in nature, the local action is first started by an electro-negative point of carbon, or by some want of homogeneity in the enamel or dentine.

9. That it occurs in pits, fissures or porous parts of the enamel through a deposit of carbon or by eremacausis of the membranous matrix, the organic portion of the enamel and dentine.

10. That a minute portion of carbon forms an electro-neg-

ative center, has been shown by the carbon placed in the notch of specimen No. 5, plate 1, having protected that side of the tooth from electro-positive action.

11. That the supposed death of the dentine is simply a well-known description of decomposition, common to all organic matter, and known as eremacausis, or slow combustion.

12. That the carbonaceous substance resulting from dry decay is at first alkaline or neutral.

13. That it is only when it has become saturated with stagnant moisture that electrolytic action commences and acid is formed.

14. That plain water is capable of producing an electrolytic decomposition of the dentine, and leaving acidity in the decalcified tissue, but that fluids containing inorganic salts produce more extensive action.

15. That sugar and water produce a more decided effect than plain water, but that saliva is by far the most effectual agent.

16. That the various acids to be found in the mouth are derived from the separation of acids from their bases, together with oxygen, obtained from decomposition of water forming the electrolyte, combining with different organic bodies, or their elements, contained in the saliva as it comes from the ducts.

17. That substances taken internally are to be traced in the saliva, is shown by the voltaic detection of iodide after taking small doses of iodide of potassium.

18. That in respect to the progressive decomposition of decay, the enamel is sometimes found corroded in holes before any signs of decay have become apparent in the dentine (*a*, Fig. 2, plate 1), showing the organic matter mixed up with the enamel to be affected similarly with the matrix of the dentine.

19. That the transparent zones of Tomes, or consolidation of the dentinal fibrils, is frequently the first change that takes place in the dentine. (Fig. 4, and *a* and *b*, Fig. 2, plate 1.)

20. That when albuminous fluids are acted upon electro-voltaically, the albumen becomes consolidated in a definite form—granular and somewhat fibrous at the positive pole, highly transparent and jelly-like at the negative, and with a densely formed wall of substance transversely between them.

21. That when dentine is electro-voltaically decalcified in

albumen, the consolidated portion between the two poles receives a deposit of globular concretions of time, almost identical in appearance with similar concretions seen in the edge of newly formed dentine.

22. That in all deposits formed in albuminous matter by electricity, a free border of transparent matrix remains unappropriated, which corresponds with the transparent rings and periosteal layer of bones and the so-called formative membranes in the teeth.

23. That the zones of secondary dentine, as also the portions of granular concretions, adherent to the cavity or scattered in masses within the substance of the pulp, are due to the electro-voltaic deposit induced by local electro-voltaic action, and that consequently calcification of the pulp is to be induced by the same means.

24. That in the consolidation of albumen electro-voltaically, the negative side is always alkaline, while that formed at the positive side is invariably acid.

25. That in this respect it corresponds with the layers of the skin, where the blood vessels, in health, are alkaline, while the epidermis and epithelium are acid.

26. That it is this condition which produces the acidity in the mucous surface of the gums.

27. That in every instance in which acidity can be traced in decaying dentine, the vessels of the pulp will invariably be found to be alkaline or neutral; thus indicating their different electro-voltaic condition.

28. That the lateral spreading of a carious cavity, and its not more extensively opening out the pulp cavity, is due to the electro-negative or opposite condition of the pulp serving as a barrier for its protection.

29. That the dentinal fibrils exert the same negative tendency in protecting the walls of the dentinal tubes, causing "the tubular substance to be first, and the walls of the tubes the last, to disappear"; and hence the improbability of effecting the same condition artificially.

30. That the decalcified surface of a carious cavity continues in a negative state as the decay proceeds, and thus keeps up the local action as it extends its area. (Fig. 1, Plate 1.)

31. That it is only after having lost the protecting influence of the healthy pulp that the cavity has its negative condition overcome by the positive and merges into the decaying surfaces.

32. That decay may be produced and carried on artificially by electricity, although the decalcified tissue requires the effect of time to accomplish its discoloration.

33. That the notches at the necks of the anterior teeth greatly resemble the effect of local electro-voltaic decalcification of healthy dentine, as produced by these means in Figs. 13 and 14, plate 1.

34. That as too viscid a state of the albumen used in the electro-voltaic experiments was found materially to prejudice the condition of the deposit of lime, so the state of the albuminous fluid of the system going to form the dentine may be supposed to exert a similar influence on the texture and hardness of the tooth as well as its predisposition to decay, and thus account for the difference in this respect occurring in different mouths.

35. That as the structure of the enamel shows it to be a portion of one of the globular crystals of lime formed in a viscid material, the so-called enamel fibres are but the characteristic features of the radiating form of its aggregated atoms.

36. That as the radiating lines in the enamel in their inward form are straight, the curves formed at the cusps are abnormal and due to a disturbing cause during the growth of the tooth, which, by disarranging the accumulating crystals of enamel before attaining their full consistence, may lessen their cohesion and thus predispose the parts to decay.

37. That the dentine forming the crown of the tooth being produced in lieu of, and occupying the place of, the cuticular layer of the skin, is consequently in a corresponding electro-*positive* state; but that the fang being encased among the negative vessels of the cutis is normally electro-negative, and hence, like the surface of the cavity in B. Fig. 10, Plate 1, its negative condition induces the formation of tartar, which settles upon it; and also in decay prevents the cavity spreading down between the pulp and the periosteum much below the attachment of the latter; but when denuded of its covering, and its connection cut off from the vessels, the exposed portion merges into the

electro-positive condition of the crown, and thus becomes the victim of decay.

38. The influence of electricity is so palpably manifested in the generation of the tooth-covering-substances which are not subject to the same changes of absorption and reproduction as occur in the vital parts, and as the effect of every voltaic series is not that of combination alone, but includes *decomposing* powers as a part of its constitution, we can scarcely refuse to accept the decomposition of the tooth substance as arising from one or more contingent circumstances connected with the same arrangement which has constituted the combining force in its production; and more especially as the effects arising in the mouth corresponded so closely with the results obtained artificially by the same means.

GENESIS.

BY HIRAM CHRISTOPHER, M. D., OF ST. LOUIS.

VII.

The evidence that warrants the belief that this world, in all its parts and departments, had, as its author, an intelligent being, is well nigh inexhaustible. We have seen that the phenomena of living beings most unmistakably point to such an origin, and that such an hypothesis alone can account for all the facts they present. The conclusion, therefore, which they, indeed, oblige is, that the life-agent is spirit as to its nature, and supernatural as to its origin, or realm of being; that it is, indeed, that power that impregns life in all creatures of whatever grade or order; and the only power competent to originate and perfect so great and complicated a work. I shall now endeavor to show by facts furnished by one of the leading scientists of the day, that the phenomena of *death* oblige the same conclusion; and that the decomposition of organic substances, and the return of their constituent elements into the inorganic world whence they were

taken by the life-agent, are effected by means which are also supernatural; and that these means are a provision especially designed for the work of decomposing organic substances, and are essentially necessary thereto. The uniformity and universality of the process of the decomposition of organic bodies, as well as the nature of the process itself, will show that such a provision was absolutely necessary to the end in view, and proves conclusively that intelligence underlies the organic world as respects both its origin and destruction.

The temporary existence of all living beings on the earth was contemplated in their creation. All are necessarily mortal, and were designed to be so. The end or purpose contemplated by their existence, and the means by which the individuals of species are produced, required that individuals should pass away by death, and be followed by others. The nature of the work which living beings were designed to effect in the world was such, and its extent so vast, that generations of beings were required for its accomplishment; and when we contemplate what vast numbers of living beings have existed on the earth during all the geological ages of the past, and observe what a great work they have wrought on the earth, and then consider the time that was necessary for this work, we cannot fail to see that some great purpose was in view, to the accomplishment of which all these were necessary. In this great work vast have been the accumulations of the reproductive system. The land has groaned under the tread of monsters that made the earth unfit for man as a dwelling place, and the seas have trembled under the motion of the vast hordes that have swarmed their waters. The remains of many of these now lie entombed in the strata of the earth. Multitudes have come upon the earth, lived their day, wrought their work, and passed away, leaving but little trace of their existence. All these multitudes were produced by the one single system of reproduction; and great as its work has been, it is yet capable of an indefinite work in the future. There is no practical limit to its operation but the supply of inorganic material, and were this unlimited, the work of the reproductive system would be equally unlimited. But it is not difficult to conceive that a time may come when exhaustion of material will take place; for what has happened locally, may happen

generally. Deserts which are now local, may ultimately extend over the whole land, and then living beings would cease to appear, because of exhaustion of inorganic material. To guard against such a contingency, and to continually afford the necessary supply in kind and quality, it was provided that living beings should die, and their dead organisms decompose, that their constituent elements might return to the inorganic world, and thus preserve the required equilibrium between the organic and inorganic kingdoms. Without death the earth would soon have been overstocked, and without the decomposition of their dead bodies, and the return of their constituent elements to their original realm, dead organisms would soon have filled the earth and made the further appearance of individuals impossible. To provide against such results, destructive of the original purpose, causes of death and means of decomposition were ordained. Yet all these designs and adjustments, we are told, are the work of physical forces!

As respects the means by which the ultimate decomposition of organic substances is to be effected, physical agents have heretofore been considered as the only means necessary for this work. We have been taught by chemists to consider these agents as alone sufficient. They have taught us that, when the body is dead, inorganic chemistry takes control, and breaks up the combinations formed by vital chemistry or the vital agent, and gradually carries the organic substances back into the inorganic world. They have told us that the material elements that compose the organism of living beings are held together in their vital relation only so long as the body is living; that, so soon as it is dead, decomposition begins under the influence and action of physical agents. They supposed that the presence and action of heat and oxygen were all that were necessary. It was supposed that vital and physical chemistry were in such antagonism in the living organism; and that the elements of its structure were in such a high state of tension, that it only needed the withdrawal of life to put the constituent elements under the full control of physical agents, and by their action alone to convert organic into inorganic matter. Decomposition of organic bodies was regarded as a natural or spontaneous process, and was supposed to begin as soon as the life left the body—that it

needed but this for the whole organism to fly to pieces, just as the particles of glass in a Rupert drop fly asunder when the state of tension is broken.

But recent investigations of the processes of fermentation and putrefaction, and some discoveries regarding the cause of some contagious diseases, seem to indicate that the theory as to the natural or inherent instability of organic bodies, is not true. This supposed instability of organic structures, especially those of more complex forms, is shown by the facts revealed by these investigations to have been an incorrect conclusion from observed phenomena. Organic matter, even that of the quarternary bodies, is not nearly so instable as it was once thought to be. It would seem that these bodies do not undergo decomposition spontaneously when the life-agent has been withdrawn, on account of an inherent instability of structure, as was the view formerly entertained. Baron Liebig regarded the process as one of combustion, the oxygen of the air, aided by a proper degree of temperature, uniting with the more readily oxidizable elements of the organic body. It was with him a process of oxidation. If this view were true, it would follow that organic bodies would always decompose if contact with oxygen be allowed. But it is now known, as a result of experiment, that organic substances will remain unchanged for an indefinite time even under pure oxygen, provided all contact with dust-laden air be prevented.

Though heat was regarded by the older chemists as necessary to oxidization, as it is in almost all cases, it was considered only as an adjuvant, it being the property of oxygen to unite with substances at a certain degree of temperature, and to part from them again at a higher degree. It is known to be necessary both to the union and decomposition of substances, organic as well as inorganic, and in many cases of the latter, alone necessary. It is also necessary to the functions of life. Though living organisms live and flourish under a very low degree of temperature, as in the Arctic regions and on high mountains; yet, for the most of them, heat in a considerable degree is essential to their growth and reproduction. In winter the functions of vegetable life are suspended because of the low temperature. In the spring, when the temperature has reached the proper and necessary degree,

these functions become active, and we again witness reproduction. Heat, therefore, is essential to these vital functions. Light also is necessary. But these agents are not the source of life, nor are they the vital principle. The plant was alive when these agents were inactive. All that we can say for them, therefore, is that they are necessary to the functions of life. The Siberian mammoth was entombed hundreds of thousands of years ago, in all probability, yet its flesh was as sound and sweet when the animal was disinterred as when it was entombed. The low temperature prevented decomposition. Still, it does not follow from such facts as this that heat is the cause of decomposition, though it certainly appears so. During a battle, when men are suddenly cut down in health, and under a hot sun, they rapidly undergo decomposition. Here again it appears that heat and oxygen are the sole agents effecting decomposition; for if it were winter, with the temperature below the freezing point, there would be no decomposition. Thus it would appear as if heat alone were necessary to set in action the decomposing forces. Such is the case in part. There can be no decomposition in its absence. And neither can there be vital activity. This is an important fact, and deserves consideration. It shows that, after all, the necessity for the presence of heat in decomposition arises from the fact that it is necessary to life, that decomposition takes place because connected with some vital process or action.

Experiments have shown that the agent that effects decomposition in connection with heat, is not oxygen. As already stated, when pure air or oxygen is kept in contact with organic matter, and under an ordinary degree of temperature, no decomposition takes place. Prof. Tyndall says that he "opened a number of tubes containing infusions of flesh, fish, and vegetables, which had been hermetically sealed for over a year, and exposed for weeks to the heat of the sun of the Alps and to the warmth of a kitchen, and when opened the infusions were perfectly clear and sweet, showing no signs of decomposition." But when these infusions were exposed to the air at the ordinary temperature, it was found that they became cloudy and odorous; and then the microscope revealed the presence of great numbers of living organisms. Decomposition and putrefaction had set in. The con-

clusion was, therefore, natural and unavoidable, that decomposition was in some way dependent on the presence of these living organisms, and that they came from the air.

The investigations that have been made during the last two decades, of the processes of fermentation and putrefaction, have led to the discovery of some of the most important facts that the labors of scientists have ever given to the world. For a long time it had been known that fermentation was attended by the appearance of a mass of cellular substance which was observed to increase in quantity as the fermentation continued; but the phenomenon was not understood until it was discovered that this cellular substance was really a living organism, whose increase in size or quantity was the growth of a living being. Some of the older chemists recognized these cells as a vegetable growth, but supposed that they originated spontaneously in the fluid during the fermentation. They did not even suspect that they had any agency in the process, either in originating it or in carrying it on. They regarded the fermentation as being the result of heat and oxygen—a purely physical process by physical agents, and the cell-product as an unexplained accident. What is now known to be the real cause of fermentation was never suspected by them. With them it was purely a physical process. So Regnault taught more than twenty years ago, and he was abreast of his times. He states, "If grape juice be collected in a bell glass completely filled with mercury, it will remain unchanged for several days; but if a few bubbles of oxygen or atmospheric air be introduced into the bell glass, a considerable volume of gas will be disengaged."* It was his view that oxygen occasioned the decomposition of the grape juice. He does not seem to have even suspected the true cause of decomposition or the nature of the process. Had he conducted his experiment as Prof. Tyndall would now do, he would have discovered, if not the true and real nature of the process, at least, that no gas was disengaged. There would have been no decomposition of the juice—no fermentation. The true explanation of such phenomena was reserved for a later day.

It was long since that the microscope revealed the existence

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* Regnault's Chemistry, vol. 2, p. 505.

of an invisible world teeming with life; of organisms whose minuteness is well nigh incredible; but it was not known until recently what part they play in the economy of nature. They seem to have been rather objects of curiosity than of affording any ground of special economic or scientific interest. But when Pasquer ended his investigations as to the cause of disease in the silk worm, a new and wide field was opened. Another world of busy workers was brought to light, workers of good and ill. Though invisible to ordinary vision, yet they are extremely numerous; though recognizable only in fluid or semi-fluid substances, yet they fill the air we breathe, as thickly as motes a sunbeam; and though almost infinitely minute in size, yet they are by no means correspondingly insignificant as to the nature and extent of the work they do. They are powerful for good or ill. They bring both to man. They were appointed for a great and important work in the world, a work which proclaims their power and numbers. Their germs in vast numbers float unseen in our atmosphere, and hundreds crowd into a drop of an organic fluid. Their beginning was coeval with the first of earthly beings, and their work cotemporary with death among living organisms. They are the ultimate carrion eaters and scavengers of the organic world. Though their footprints are not seen in the sands of the ages, yet their remains are not absent from the strata of the earth. Their skeletons lie entomed in the crust of the earth, and to-day serve a valuable purpose in human art.* Lying beyond the boundaries of human vision, and unfit for uses which many other organisms lend to man; yet they serve him in things which lie beyond the range of the higher forms, and accomplish for him a work absolutely essential to his welfare. Their existence in the beginning of living organism on the earth was, therefore, in anticipation of wants occurring all along the ages of life on the earth, and demonstrates that a mind grasped all the phenomena of earth, and an intelligence presided over the whole, at once capable of comprehending the needs, wants and contingencies of life on the earth, and of meeting these with means perfect and adequate. The function of nutrition called for a wide field of supply, and those of growth and

* Lyell's Elements of Geology. p. 24.

reproduction supplied the want; but the agency of nutrition has been found necessary to the opposite state of organic bodies—their growth and putrefaction; so that nutrition is found to be not only a process necessary to life, but also to the purpose of decay and ultimate decomposition of organized bodies.

Some late and careful experiments in regard to the processes of fermentation and putrefaction have shown that these are really and truly vital processes, and not physical, as heretofore considered—that the decomposition of organic substances takes place only in connection with nutrition, and as a consequence thereof. Two phenomena are conspicuous in these processes—phenomena readily recognized, viz: The nutrition of living organisms and the decomposition of their pabulum, and seem to place beyond question the fact that there can be no decomposition of organic substances without the concurrent nutrition of living organisms. What the larvæ of the fly do in a dead animal, the bacteria also do. The one are visible, the other are not. The former were deposited by the fly as eggs; the latter, as germs, came from the atmosphere, the ova of former generations. Both nourish, grow, mature, and reproduce, as do all living organisms. Hence, the primary and leading functions of the organic world are nutrition, growth and reproduction. These are its primary phenomena. The phenomena of death are but the consequences or results of the phenomina of life! Is it possible, then, that phenomena so linked and dependent are but the provisions of physical agents, or of the passive forces of matter?

There is nothing peculiar or exceptional in the nutrition of microscopic organisms. If the decomposition of organic substances attends it in one instance, as there is uniformity in the laws of nature, we may be certain that it universally and invariably accompanies it. Sugar, we know, is decomposed by a ferment. The ferment is invariably a living organism. This is now regarded as an established fact. As we observe the products of fermentation to increase, we observe a corresponding growth in the organism. The two processes proceed in parallel lines. The same phenomena are observed in the changes that take place in the higher plants. In the sugar cane, maize, maple, pulpy fruits, etc., sugar subserves the purpose of nutrition at certain periods of the growth of the plant. In the early part of

its growth, sugar is readily detected in the crude sap; but at the flowering period it disappears, a fact to be explained only on the supposition that it is coverted into some isomeric body, or that it was used in nutritrion, the latter more probably.*

Prof. Tyndall has shown that a fluid capable of undergoing fermentation or putrefaction, after having been properly prepared and carefully excluded from contact with dust laden air, will continue unchanged indefinitely at the temperature at which it would decompose if exposed to the air. He believes that it would never decompose. On the other hand, it is certainly true that the fluid will ferment or putrefy if it shall be subsequently exposed to the air. Having demonstrated by experiment that pure oxygen, though aided by the necessary degree of heat, will not excite these processes, he concludes that these changes in organic substances are to be solely ascribed to the agency of the organisms whose presence in the fluid in large numbers, is revealed by the microscope. This conclusion was corroborated by numerous experiments variously and carefully repeated. It was found that neither fermentation nor putrefaction take place without their agency. Hence he says very confidently that "It is these organisms, and other analogous, though apparently motionless ones, which, by decomposing the milk, render it sour or putrid. They are the lactic and putrid ferments, as the yeast-plant is the alcoholic ferment of sugar. But milk may become putrid without becoming sour. Examine such milk microscopically, and you will find it swarming with the shorter organisms somtimes associated with vibrios, sometimes alone, and often manifesting a wonderful alacrity of motion. Keep these organisms and their germs out of your milk, and it will never putrefy. Expose a mutton chop to the air, and keep it moist; in summer weather it soon stinks. Place a drop of the juice of the fœtid chop under a powerful microscope; it is seen swarming with organisms resembling those in the putrid milk. These organisms which

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* This fact would seem to indicate that the pabulum of plants is really organic matter, and not inorganic as generally supposed. The same is the case with the growth of a plant during the stage of germination. The inorganic substances conveyed to the leaves are there decomposed and formed into organic bodies which then become the food of the plant. The leaf is an artopoietic organ.

receive the common name of bacteria, are the agents of all putrefaction. Keep them and their germs from your meat, and it will remain forever sweet."*

Prof Tyndall, it would seem, believes that organic substances will not undergo decomposition except through the agency of living organisms. Whether this is true in all cases and under all circumstances when the necessary conditions are present, as in internal abscess, or senile gengrene, the professor does not state; but his language implies as much. As he is somewhat favorable to the theory of Evolution, though denying its fundamental thesis—spontaneous generation—the statement is accepted as true, that the agency of living organisms or their germs, is necessary to the decomposition of organic substances; and the fact is here employed as an *argumentem ad hominum*, without expressing any opinion as to the universality of its truth. —*St. Louis Medical and Surgical Journal for July.*

Microscopy and Histology.

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PRACTICAL STUDIES OF THE DEVELOPMENT OF THE TEETH.

NO. IV.—STAINING.

Staining sections has for its object the clearer illustration of the morphological elements of the parts examined. For the fulfillment of this purpose something more is required than the mere tinging of the tissue as a whole. This might increase the beauty by giving a more agreeable color, but would not aid us in determining the characteristics of any particular tissue. It is therefore required that the staining be selective—by which is

* A discourse delivered before the Glasgow Science Lecture Association, Oct. 19th, 1876.

meant that certain elements of the tissue be stained while other certain portions are not stained, or that the intensity of the staining of the different elements differ so markedly that they will be readily recognized by the eye. It will be seen at once that any staining which fails in this will be of no material aid to the microscopist.

Selective staining is rendered possible by the differences of the chemical constitution of the different tissue elements and its success will depend upon our skill in adapting our dyes to these tissue differences. For illustration, carmine is readily dissolved by the alkalies, and is again precipitated by acids. Now, if we dissolve carmine in a fluid which has been rendered just sufficiently alkaline to hold it in solution, and introduce into this a fabric, certain portions of which have been rendered acid, while other portions are neutral, the whole fabric will be stained or colored by the carmine, but upon washing the fabric in water—a neutral fluid—the carmine in the neutral portions will readily wash out, not being fixed or precipitated by the acid, and the fabric will be found colored in the patterns designed by the application of the acid reagent.

Now in the living tissues of the body it is found that certain parts possess by virtue of a slight difference in acidity this power of *fixing* certain coloring matters. Hence we must adjust our staining fluids chemically to meet these differences.

The nuclei of the cells are slightly more acid than the cells; some classes of cells are rather more acid as a whole than other classes. In the epithelium the lower cells—those that lie against the true skin—and a few layers stain readily, but their nuclei stain more readily still, and will, therefore, take a deeper color, while the outer layers of cells will receive but little or no color.

The secretions of some glands are alkaline and will thus prevent the staining of the gland cells with which they are in contact while the interlobular tissue may be stained, thus surrounding each individual lobule with color and marking its boundaries, while in others the gland cells themselves receive the color markedly so that they may be stained to the exclusion of the interlobular tissue. Muscular fibres receive carmine while the material with which they are united in bundles does not, and so we

might go through the entire list of the tissues, but this is unnecessary. We only wish to impress upon the mind of the reader the necessity of making the chemical adjustment of the staining fluids with nicety, for we may introduce so much ammonia (the alkali usually employed) as to defeat our object, or the introduction of the stained section into the acid mounting fluid before washing in a neutral fluid would equally defeat our object by fixing the color in the entire section.

Then, again, we must not expect good results in staining tissues that have been long dead, for these nice chemical distinctions are only maintained during the life of the tissue elements—they may arise at the time of death—which cannot be long continued after the death of the animal. For this reason it is important that the staining be done at as early a date after death as possible, and that care be taken not to macerate in other than neutral fluid. The best results in staining are obtained by injecting the staining fluid into the blood-vessels of the animal at the moment of death. We think the next best results are obtained in staining the sections cut by the freezing method which has been done as soon as possible after death. Sections prepared without loss of time by the gum arabic method stain moderately well. Preparations kept in alcohol will stain reasonably well, even after a considerable time, and some degree of selective staining can be obtained in almost any tissue, no matter how long dead; but generally it will be found that old tissues will give the best results if left plain.

Carmine very justly, as it seems to us, holds the first place as an agent for staining tissues for microscopic investigation. This is largely on account of the facility with which it becomes *fixed* by very slight acidity and its permanence.

The color is at the same time very beautiful, especially in the variegated tints obtained in sections containing a variety of cells as in sections of the developing jaws connective tissues intermixed with glands, muscular fibres, etc.

Quite a variety of carmine staining fluids have been devised, but they all, or nearly all, agree in that the carmine is dissolved in an alkali which is afterwards largely diluted with a neutral fluid.

The following is recommended by Beale as being very good:

Carmine	Gr. 10.
Strong Liquor Ammonia	℥ ½.
Price's Glycerine	℥ 2.
Distilled Water	℥ 2.
Alcohol	℥ ½.

The carmine is first dissolved in the ammonia over a spirit-lamp, and then boiled for a few moments, and set aside for an hour to allow the excess of ammonia to escape, after which the other ingredients are added. The whole is now filtered or allowed to stand for some time, and the clear fluid poured off and kept for use. If carmine should be precipitated, a drop or two of ammonia should be added.

We have used this fluid considerably and have found it well adapted to selective staining, and if but one fluid be used we think it the best we have tried. The section is placed in the fluid for a few minutes, or for half an hour or more according to the intensity of the color desired or to the nature of the tissue; these points to be determined in each case by trial. The section will appear of an uniform red; it is now placed in clear water and moved about to wash away the carmine not fixed. Sections stained with carmine should always be placed in a weak solution of acetic acid for a few minutes, after being washed. The color will be seen to become a brighter red, and will be more perfectly fixed, after which it may be mounted in any manner desired.

If mounted in glycerine, a trace of acetic acid should be added.

We are much in the habit of using a simple saturated solution of carmine in ammonia which is made by putting as much carmine in aqua ammonia—to which about two volumes of water has been added—as it will dissolve, which is set away for use. When we wish to stain an object, we mix a little glycerine and water, about equal parts, and add the carmine solution, drop by drop until the wished for color is obtained, and then immerse the object to be stained, which is treated with water to remove the excess of carmine, and mounted as above described.

The use of the fluid in this somewhat indifferent way, perhaps requires a little more experience, which, however, is very

soon acquired, yet by it we have the advantage of regulating the depth of color at will; and will often derive a marked advantage by staining very slowly with a weak carmine color, in which the section may remain for several hours; sometimes when we fail to get a good selective staining in very red solutions, we will succeed by using a very pale solution and continuing the process for a longer time. It is curious to see the section gradually attract the color until they are of a very much deeper red than the surrounding fluid.

THERSCH'S CARMINE FLUID.

Carmine	1 Part.
Caustic Ammonia	1 Part.
Distilled Water	3 Parts.

This solution is to be re-filtered.

A second fluid is prepared of

Oxalic Acid	1 Part.
Distilled Water	22 Parts.

One part of the carmine solution is mixed with eight parts of the Oxalic Acid solution, and twelve parts alcohol added and filtered.

If the filtrate is orange colored instead of dark red, more ammonia is to be added to compensate for the preponderance of oxalic acid, and the orange becomes red. The orange color may be used for staining. If crystals of oxalate of ammonia are formed in the fluid it must be refiltered. (Frey.)

This fluid stains very quickly. The sections should be washed in alcohol.

LILAC CARMINE FLUID, OR BORAX CARMINE.

Borax	4 Parts.
Water	50 Parts.
Carmine	1 Part.

Dissolve and mix with twice the volume of alcohol and filter. We have found this fluid to give very beautiful results, but quite different from the ammonia fluids. In staining a number of sections from the same object, the different colors may be used with advantage.

Many blue staining fluids have been devised. We have made some very pretty tingings with the following:

Sulphate of Iron.....30 Grs.
Prussiate of Iron.....10 Grs.

Dissolve each separately in an ounce of water.

Macerate the section for a few minutes in the prussiate of iron solution, and then transfer it to the sulphate solution when it will be colored blue; wash it out in water if the color is too intense, and mount in very slightly acidulated glycerine. A greater variety of shades from a light green to a deep blue may be obtained by varying the solutions and the manipulations.

Very many other staining fluids might be given, as they may be varied indifferently. Each experimenter will vary his fluids at pleasure after he has acquired the habit of proportioning them.

ON A METHOD OF TREATING SENSITIVE DENTINE AND EXPOSED PULPS.

BY A. H. THOMPSON, D. D. S., TOPEKA, KANSAS.

The necessity for the classification of the two dental lesions of sensitive dentine and exposed pulps in the same pathological and therapeutical category, has not been sufficiently recognized by the members of our profession. The intimate physiological connection and relationship of the dentine with the pulp, taken together with the fact of the formative origin of the former from, and its nutritial support by, the latter, argues the necessity of this recognition; and if, while bearing this in mind, we take a step further into the pathology of the two tissues, we must be convinced that their connection and sympathy in disease is very close and intimate. We can believe, therefore, that any disease and inflammation of the dentine must excite the sympathy, at least, and perhaps the active participation also, of the pulp; and also that disease of the latter will affect the dentine so far as its nature will permit.

Caries is by far the most common and destructive disease to which the dentine of the teeth can be subject, and to the treatment of its painful results this paper especially refers. We hold that in the various degrees of its progress and of the manifestation of its effect upon the dentine, the pulp participates to the extent of a sympathetic irritation of corresponding extent to the progress of the lesion in the dentine; controlled, of course, always, by the various idiosyncrasies of the teeth and the patient. If we take a typical small cavity of decay in which we find more or less sensitiveness to the excavating instrument, and but little or none to ordinary irritants, there is, even though of small extent, a participating, sympathetic irritation of the pulp. In a somewhat larger cavity, where there is greater tenderness to the instrument and perceptible sensibility to some of the ordinary irritants—such as air or saliva, thermal changes, condiments, etc.—there is active participation of the pulp which a sensation of pain will often render apparent. In a cavity yet larger, in which the pulp is almost exposed, we usually find the dentine exquisitely painful to the instrumental touch and extremely sensible to ordinary irritants, and the pulp on the eve of odontalgia from the irritation of the dentine. Going further and taking a cavity in which the pulp is entirely exposed and aching, we find active pulpitis brought on by a gradually increasing, abnormally irritated condition of the dentine, until the disease creates actual exposure to the air, and consequent pain. In a further condition of a suppurated pulp, the dentine has begun to die and the pulp is itself approaching death.

This sympathetic participation in disease is due, of course, to the connection of the two tissues through the contents of canaliculi or tubuli of the dentine. We have yet to conceive of and appreciate the fact, in our treatment of caries of the dentine, that this tissue is more nearly allied to bone than to enamel, and that we dare not presume upon its being a structureless epidermal substance, which we can cut and lacerate with the same impunity which we exhibit in cutting the digital nails or the hair of the body; yet this principle underlies our present methods of operating upon carious teeth. We cut and prepare a sensitive cavity, and fill with highly-conductive metals to within a millimetre of an already irritated pulp, and then

wonder why that tooth should continually be sensitive to thermal changes, electrical contact, etc., or why the pulp should, perhaps, die, with or without much pain, and periostitis, abscess, and, possibly, necrosis follow. We do not appreciate the fact that we are dealing with irritated bone, in a condition similar to inflammation in vascular tissues, and that when so irritated we are trifling with a volcano, by filling upon it, and taking the risk of the smallest chance of escaping disaster.

The point we would especially urge is, that sensitive dentine and aching pulps are due to the same cause—*i. e.*, exposure to the irritating effects of the air, saliva, thermal changes, the chemical effects of condiments, etc., the air being the chief irritant; and that the difference between the two lesions is one of degree but not of kind; there being, in fact, a graded connection between the various degrees of disease and pain from the moment of sensation in a minute cavity on through the various stages to a raging pulpalgia.

Simple reason would suggest the best treatment of this condition of pain to be its alleviation and the protection of the parts from the irritants which induce it, and it is upon this principle that the method submitted is based. The irritated and semi-inflamed cavity walls must receive palliative treatment, irritating agents be thereafter excluded from contact by the mechanical filling and closure of the cavity, and time be allowed for the recuperative efforts of nature for a restoration to normality.

The material used for this purpose is principally oxychloride of zinc, which, being a cement with certain antiphlogistic properties, used in connection with an intervening material to prevent cautery of the pulp or of the dentine near the pulp, is preeminently adapted to the purpose. The abuse of this very valuable substance has, however, brought it into disrepute with the mass of the profession; but undeservedly so, for with the continued success the writer has had in its use, it is scarcely claiming too much to say that it is one of the most valuable acquisitions that have been added to our resources for many years. Every material can be abused so as to be worse than useless, and while being conformed to harmonious application to use, is frequently so abused. Oxychloride of zinc is no exception to this rule; but it is now time that the period of its empirical abuse

should be brought to a close. The harm done has been through experimental and mistaken methods in its employment, which could scarcely fail of doing injury. But these faulty methods, having been discovered by dearly-bought experience, should be abandoned. It is the object of this paper to describe methods of using oxychloride which have been almost universally successful, and which recommend themselves to general employment. These processes have been developed through several years' use of oxychloride, by suggestions from various sources, and by experiment, until the following methods, which are to be detailed, were perfected: these having now been used for some few years unaltered and with great success.

Beginning our descriptions with a small, simple cavity, which we find so exquisitely sensitive to the instrument as to almost or quite preclude operating (such as are usually found upon the buccal faces or cervices of molars and bicuspids), the method of treatment is, first, to remove so much of the carious *debris* as can be well done by using an excavator loosely, and then to saturate and cauterize the cavity with clove oil or carbolic acid, or both. After drying, the oxychloride should be used in a thick cream, pressed home well and solidly, dried with spunk, and covered with a drop or flow of sandarac or shellac varnish. This filling should remain for from three to four weeks before attempting to insert the metal filling, when the cavity can then be prepared and filled with ease and deliberation. If the patient is strong and in good health and the teeth are of good quality, three weeks will be sufficient; but if the patient is asthenic and nervous and the teeth of bad quality, a longer time will be required to secure results. On the removal of the oxychloride very little sensitiveness will be found, in most cases, and the operation can be completed with a certainty which most assuredly could not have obtained in the first condition. This beneficial result has been brought about, mainly, by the mere exclusion of the irritating contact of the air, to which, of course, other irritants contributed their effects. The caustic properties of the oxychloride have also aided, in the beginning of the treatment, the reduction of sensibility, and the exclusion of all irritants for a time has completed the treatment and enabled nature to restore normality.

Next, taking a typical cavity of small, ordinary size, in any position, the treatment will be about the same as the preceding, except that the carious *debris* in the bottom towards the pulp would best be left, which, after saturation with carbolic acid, will protect the canaliculi leading directly to the pulp, and obviate any unsafe irritation of this organ. In both this and the preceding type there will likely have been no sensibility to ordinary irritants, however much there may be to the excavator But on going further and taking a larger, ordinary cavity, there will likely have been some sensibility to cold air and some condiments. It will be advisable to use in this cavity, even at so early a typical stage of encroachment upon the pulp, an intercepting and protecting material in its direction. This will consist of any ordinary and innocuous powder as a vehicle (whiting answers the purpose very well and absorbs the fluid readily), made into a paste with clove oil or carbolic acid, as the case may require. In this type, after removing as much of the carious *debris* as possible from a zone within the edges of the enamel, the bulk of the attached decay is allowed to remain in the bottom and saturated with carbolic acid. This decay is then well covered with clove-oil paste pressed lightly into place and dried with spunk. The oxychloride is then applied in thick paste, pressed lightly but firmly into place and dried with spunk, and varnished. This will have to remain for from four to six weeks, as may be indicated by the idiosyncrasies of the patient and of the teeth.

In a cavity of a still larger size in which there has been a greater or less amount of sensibility to external irritants and perhaps a little aching, we reach a type which requires extremely delicate handling, and the demand for delicacy increases as we proceed with still worse types. In this class of cases the direct application of the oxychloride must be carefully avoided, for the danger of causing death of the pulp from its cauterizing effects is very great, and the interposition of the oil paste becomes an important part of the process, the neglect of which will likely event in disaster. The result is the ordinary concomitant of such an unwarranted abuse of oxychloride, and which has brought this material into undeserved disrepute. In the case under consideration, after removing the loose *debris* and the

attached carious matter from the marginal zone, the still attached decay in the bottom is let remain as the best possible protector of the thin lamina of dentine next to the pulp. The cavity is then saturated with oil of cloves, followed by just a touch of carbolic acid, clove-oil paste applied thickly to the decay and pressed lightly into place. The oxychloride is then applied in a stiff paste, packed against the periphery of the cavity, pressed lightly to render solid and dry, and varnished. By using the oxychloride stiff the caustic effects of the zinc chloride are reduced to a minimum, as there is no surplus fluid. The filling is also thereby rendered more dense and hard, and will wear better, as this must left untouched for from six to eight weeks.

The next type is that of a simple exposure of the pulp of recent occurrence in which a little aching has occurred. After the removal of loose *debris* merely, clove oil should be applied under sandarac and cotton, or other stopping, for twenty-four hours. If the aching is obstinate, carbolic acid must be added to the application. The mixture of iodine and aconite should be applied to the gum tissue over the root. If all has been quiet on the return of the patient, the following, or perhaps the second day, the carious matter should be removed, except over the pulp, and the cavity nearly filled with clove-oil paste, leaving merely a sufficient space within the margin of the cavity to retain the oxychloride. This should be mixed well into a stiff paste, applied, and packed carefully against the walls with instruments, pressed and dried delicately with spunk, and varnished, and an application made to the gum. This must be left for six or eight weeks.

The next type is that of complete exposure of the pulp which has been the cause of considerable suffering, but is comparatively recent. The exposure is not of long standing, and there is as yet only inflammation and some congestion, but no suppuration of the pulp. After removal of the *debris*, clove oil and carbolic acid are appled for twenty-four or forty-eight hours, and the application made to the gum. If it does not quiet, the treatment must be renewed, with, if the suffering is excessive, the addition of chloroform or morphia. But if all has been quiet on the return of the patient, the clove-oil paste should be applied to nearly fill the cavity, and merely covered with andarac or

other stopping for twenty-four or forty-eight hours longer. If still quiet, sufficient of the paste is then removed, and a narrow zone prepared within the margin of the cavity to receive the oxychloride, which is applied as in the previous case. This case must be left for eight or more weeks before inserting the metal filling.

The next type is that of an exposure of some weeks' or months' standing, in which pain has been rather intermittent. It may be that general comfort has been maintained by a sort of sufferance, or that occasional severe paroxysms of pain have supervened. Pain is manifested in various degrees and manners in this class of exposures, and the pulp is at different times in different conditions. It may be merely in a chronic condition of congestion, or it may be in a state of partial suppuration, or again, perhaps a fungous growth from the orifice of exposure may relieve the congestion. But in any event or condition in which an ordinary exposure of long standing may be presented, it offers at best an unfavorable prognosis; and yet, although the chances are against the probability of the conservation of life, we feel warranted in proceeding upon a hopeful method of treatment, even for the smallest chance. In many cases the idiosyncrasies of the patient will justify this risk, and in others, again, any attempt to preserve life will be contra-indicated; each case must be "a law unto itself." In such as allow of the attempt, the first step in the treatment is, after removing the *debris*, to saturate the cavity well with oily carbolic acid. This is severe, perhaps, but a pulp in an extremely congested, suppurating, or fungous condition will require heroic treatment. Life is nearly gone, and the treatment must be prompt and thorough. The medication is allowed to remain in contact with the pulp and cavity for twenty-four or forty-eight hours, and an application of the iodine and aconite mixture made to the gum. At the expiration of the specified time, if all has been quiet, or nearly so, the paste made with carbolic acid is applied carefully, and dried, and the cavity again stopped for a day or two. At that time, if all is yet quiet, the oxychloride is applied carefully in a stiff paste, and the case left for two months or more. If the odontalgia should be difficult to overcome, or should recur after the insertion of the temporary filling, the application must be renewed or

varied by the addition of clove oil, chloroform, or morphia, or as a last resort, arsenic.

We hold that a large enough percentage of pulps may be saved alive by this treatment to warrant the attempt in all cases where the indications are at all propitious, or will even promise a chance. And if it fails,—if aching should recur which cannot be quieted, except by devitalization, if the pulp should die and cause periostitis, or if the pulp be found dead upon removal of the temporary filling—the one resort still remains of canal treatment, but which we are not warranted in resorting to until everything else fails, and we are compelled to devitalize. The rule should be laid down that every exposed pulp which is not on the verge of death, or whose prospects are beyond all hope, should have a chance at least for life and usefulness.

After the lapse of the specified time of probationary treatment in each case, the oxychloride filling should be removed, the paste taken from the bottom, and the carious dentine thoroughly removed to safe depth. This safety-line will be found by avoiding encroachment upon the hard but discolored dentine, which must be left as the best protector of the pulp. This is well covered with the oil paste, which is carefully dried into position. A good capping of stiff oxychloride is placed carefully over the oil paste, and dried, the preparation of the cavity completed, and the metal filling inserted. This is the treatment which has been found most successful for exposures and large cavities, but in small cavities which were treated for sensitiveness alone, the oxychloride is removed and the cavity prepared and filled in the ordinary manner.

It will be found that in the majority of cases the sensibility to cutting will have subsided to a minimum of pain by this treatment, and that all cavities so treated will have been much benefitted. In especially nervous and asthenic patients the benefits are sometimes not as great as we could wish, but even in the worst temperaments and most sensitive teeth the pain of preparation can be considerably reduced, while in all ordinary cases the benefit is very great. There can be no doubt that the reduction of sensation in irritated dentine is a great desideratum, and that extreme sensitiveness interferes very greatly with the certainty of success in filling. There is also no doubt that we do not pos-

sess, as yet, a safe and efficient means of obtunding and overcoming this sensitiveness instantaneously, so as to permit of deliberate operating. In view of these facts, the method above proposed is especially recommended as safe and certain, its only objection being that it requires a few weeks' time, but this should not be counted against it when the results are so important. Much the same may be said of the method of treating exposed pulps, for in this dangerous lesion the time required is surely justified by even a chance of success.

The danger to the life of the pulp is entirely obviated by the use of the intervening oil paste, which effectually protects this tissue and the canaliculi immediately leading to it from the caustic effects of the zinc chloride, while the tubuli of the periphery are either cut off entirely from communication with the pulp, or are at such distance as to not endanger it. The proof that the vitality of the pulp or dentine is not impaired in the least by the effects of the oxychloride is furnished by those cases which are unfortunately neglected until the filling wears and dissolves either partially or entirely away, again exposing the dentine and, perhaps also, the pulp, to the exciting irritants, when sensibility and pain will again ensue. This occurs only too frequently by the neglect of the patient to return at the proper time, and the whole process must then be repeated.

It is essential that great care should be taken during the introduction both of the oil paste and the oxychloride in cavities which approach the pulp or expose it, to avoid pressing with the spunk or instruments in the direction of the pulp with any force beyond that which is barely sufficient to dry the paste. This care is so essential that a slight compression of the pulp, or even of the dentine over the pulp, will usually produce an amount of mischief and suffering that is one of the most difficult forms of odontalgia to overcome.

It will be found advantageous, in taking charge of nearly every denture for the filling and conservation of the teeth, to perform the operation (among other attentions preliminary to filling) of treating and filling every open cavity with oxychloride. The size and sensitiveness of each cavity will govern the method of its filling of course, and it will be found that much time will often be saved by this anticipation of sensitiveness. Very fre

quently a cavity will be exquisitely sensitive which has given no previous indication of such a condition, and in such a case anticipatory filling is often a very fortunate forethought. In the cavities of a denture so treated a little time can be given them while the lesser cavities are being filled permanently, so that by the time the treated cavities are reached, one, two, or perhaps three weeks have elapsed, and the denture can be completed without any waiting for the treatment of sensibility or exposure. Whereas, if each open cavity had not been so treated in advance, some of them would have required time and waiting, and thus have caused inconvenience to both patient and operator, which might have been saved by anticipatory filling. Many dentures thus treated by the writer testify to the practicality and advantage of this system. One case recently completed illustrates this directly, in which thirty-five fillings were made in just one month, many of which, but for the filling of all open cavities at the first sitting with oxychloride, would have required treatment, and another month would have elapsed before the completion of the denture. In this case, as in many like it, no aching had occurred, but a few of the cavities were sensitive to mastication or the touch, but no pulps were lost, and much time was saved by immediate attention.—*Dental Cosmos.*

Journalistic.

The *St. Louis Medical and Surgical Journal* reports a discussion which was held in the Evansville Medical Society, in which the merits and demerits of salicylic acid were under consideration, and the testimony of those who had used this remedy in rheumatism was not calculated to increase our confidence in its efficacy, whilst considerable evidence was furnished which went to show that if continued for any considerable length of time it was a dangerous remedy, and that in a good many cases its ad-

ministration had been followed by fatal results. In acute cases it seems sometimes to do good, but in chronic rheumatism in nearly, if not all cases, it is totally useless.

The second number of the *Dental and Oral Magazine* is at hand containing not only a report of the January meeting of the Odontological Society, but a very considerable amount of other reading matter, so that it approaches much nearer in appearance the other Dental Journals. Although this number contains considerable variety of interesting articles, we shall not be able to glean much from it which will be new to the profession. The selected articles upon the germ theory and upon contagion are valuable, and some of the discussions in the Society proceedings are of much interest.

The *Pacific Medical and Surgical Journal* objects strongly to the appellation of Allopathy as applied to the practice of medicine. We have always protested against the use of the word, and we supposed that all physicans knew that the word was the offspring of the various isms and pathies which infest mankind but that physicians discarded it altogether. From this Journal we learn that California has a medical law which was intended to protect the people of that State from the impositions of quacks.

The *London Lancet* has found a mare's nest. In a recent number of that enterprising Medical Journal it is announced that in Munich a dentist has actually succeeded in extracting a tooth and replanting it in its socket in such a manner that it has again become firmly fixed. We don't suppose the *Lancet* man ever heard of John Hunter who performed this operation many times, although by no means the first one who practiced it; and I need not, of course, inform the intelligent readers of this JOURNAL that the operation has been performed thousands of times, and that hundreds of dentists have performed the operation frequently; but we make these remarks for the benefit of those brilliant editors of Medical Journals who have copied the item from the *Lancet* into their own pages. We suppose it will be necessary for us to explain for the benefit of the *Lancet* and *clippers* who have enriched their own columns from its pages, that John Hunter was a surgeon of some celebrity, in fact an

author which some physicians and surgeons have considered it worth while to study, and who was well aware when he was performing this operation of replantation that others had been accustomed to perform it long before his time. We hope the *Lancet* and *British Journal of Medical Science* are not fair specimens of the Medical Journals of the present day across the water.

We have received the First Annual Announcement of the Dental Department of the University of Pennsylvania. This is indicative of what is in store for the Dental profession. It means that the time is not far distant when Dentists will actually be as well educated as Physicians; and when the Dentists are educated in such institutions as Harvard University, Michigan University, Pennsylvania University, and St. Louis Medical College, with thoroughly organized special departments, we shall hear no more complaining about not being fully appreciated by the Medical profession. The highest ambition of the scalawag members of the Medical profession, who embrace some of the outside isms or pathies in order to sport an M. D. in two or three months, is to be recognized by a regular Physician, and they are always complaining of being maltreated by Medical men who are *not* frauds, but if they would only labor for a reputable position as the true physician has done, there would be no more complaints of that nature.

In the *Cosmos* for June we find a letter from Dr. E. Townsend, written after his experimentation upon Amalgam, which shows very plainly the great weight which attaches to statements of the New Departists when they attempt to strengthen their positions by quoting from Dr. Townsend. The letter is as follows and remember it was written after he had concluded his experimentation upon this subject:

MARCH 2nd, 1858.

MY DEAR SIR :—I sent back the amalgam fillings to you without comment, as I was then too feeble from an attack of influenza to write.

I will now say to you that I am very sorry I ever was induced to advocate it, as I see it has been grossly misused, and it has also failed *me* in the very cases where I most relied upon it. I have thrown it aside entirely, emptied my bottles, and *will never* use it again in *any* case. My brother Charles, my brother Edward, and my brother in law, Mr. Kirk, have also pledged themselves to me never to employ it.

I shall appear in the next number of the *News Letter*, when I hope to make my recantation clear to all men. I very much regret it, and shall not be ashamed to own.

In one thing in the past year my conscience is clear to my patients and to the profession. I have taken unusual time, pains, and care with my gold fillings, and not having been so crowded as to be uncomfortable, I think I may say have put in more perfect "stoppings" than ever I did. This little brag I hope you will think pardonable as an offset to some of my BLACK deeds, and besides, *you* know I can fill teeth.

Very respectfully yours,

DR. J. D. WHITE. E. TOWNSEND.

The *American Journal* for June exhibits a considerable amount of vitality. It has an editorial of nearly two pages, and we must say that it is a very sensible one, too. No new departures seem to go down with the old *American Journal* without there are some facts really established which might give some foundato stand on.

This number of THE JOURNAL finishes the year since we took upon ourself the control of the MISSOURI DENTAL JOURNAL, and on account of our leaving the city, and, at least for the present, the practice of Dentistry, with this number our connection with THE JOURNAL will cease. We hope its future will be controlled by abler hands. With the kindest regards towards our readers we bid you one and all an affectionate farewell. J.

SWALLOWED A RUBBER DAM CLAMP.

A little girl, twelve years of age, while undergoing some operation on her teeth, at the office of Dr. ———, San Francisco, by some accident got a rubber dam clamp into her throat. Finding it impossible to remove it by the mouth, the dentist forced it into the stomach. The patient passed it from the bowels forty-eight hours afterwards, with no unpleasant results. The clamp was one of Dr. Blake's set for an inferior molar.

To provide against accidents of this kind a string should be attached to the clamp, in all cases where there is a possible chance for it to get into the throat, through accident or carelessness.

J. W. WINTER.

MECHANICAL DENTISTRY.

BY D. J. MCMILLEN, D. D. S.

(Read before the Missouri State Dental Association, June 6th, 1878.)

MR. PRESIDENT AND GENTLEMEN:—It is with considerable reluctance that I have to present to you a few of my thoughts on the much ignored subject of Mechanical Dentistry, so called. I am aware my opinions are not in accordance with some of our best dentists, therefore, I suppose I am on the unpopular side of this question, but having been appointed to give my views upon this subject, I feel it incumbent upon me to do so. I am sure in presenting this matter, that some of our city brothers may not know that we country dentists have a very different class of patients from theirs, and the plain fact is, we must be good mechanical dentists to make the practice of dentistry a success at all in the country. We may weave our webs of fine spun theory of saving teeth as much as we like, still we are compelled to witness the unavoidable loss of at least a limited number of the natural teeth. Though we may work and study hard to save them it is simply impossible, according to my understanding of dentistry, to save them all, even though our patients were willing and ready to pay liberally for our knowledge, skill, and hard work; which a great many will not do. Often I find my store of knowledge exhausted, and finally have to extract the tooth, which of course is very annoying to me, but none the less necessary to the comfort of my patient.

There are, also, a great many diseases incidental to human nature which naturally render the extraction of the teeth a necessity, and even a blessing, to the long suffering patient. I have just had a case of this kind where I was obliged to extract the teeth. I presume there are none that will deny, that a certain number of natural teeth must necessarily be sacrificed, and therefore the skill of a good mechanical dentist is often brought into requisition; and I hold that every operator, though he might never have to construct a plate, should know how to do it and

know when it is well done, and I do not even consider anyone a thorough dentist unless he can construct a first-class plate on at least gold, celluloid, or rubber.

There is no doubt, in my mind, that the too common opinion prevails amongst our better class of dentists, that the art of mechanical dentistry is a humbug, and all good operators ought to quit making plates, and, I suppose, hand it over to the scalawag.

I admit it is not quite so nice as operating, and I like to operate much better than to work in the laboratory, but with me laboratory work is a necessity, and I consider it requires full as much skill and ability or even more to construct a neat case in the plate department as it does to insert a good gold filling. Through the competition of the cheap scalawags this branch of our profession is much degraded; but if we can make our patients understand this matter properly, and I am sure we can, we might be able to crush out this growing evil. Would it not be better by way of practical demonstration, to labor hard and long to correct this matter, than to uphold only a part of our profession, for I believe this to be one of the very important branches. Some will say, any one can make a plate in a few months, which probably is the fact, to some extent, but it takes years of hard study to make a thorough mechanical workman. Indeed, I believe, it requires a better artist, and more hard study in selecting the kinds of teeth in different cases to restore the features to their normal condition than any other part of the business.

I am aware, I am not on the fashionable side of this matter, but as I believe I have presented the plain facts in the case, I rest content; I also know that some of the professors of our schools are in favor of graduating operative dentists, separate and apart from the mechanical branch. Now I am in favor of giving the student a wider range, if any difference, but never detract any from the now established standard; there is now entirely too little attention paid to the plate-work department in many of our dental colleges. How many are there to-day in St. Louis who are able to master all of the so-called mechanical parts of dentistry in all its various forms? I have seen some very small cases, such as regulating plates, puzzle the best of them; still they will say, mechanical dentistry does not amount to much.

Now this is becoming a very fashionable opinion, but I believe a very bad one, and I am sorry to see a great many of the young members of the profession drifting that way; and I do hope this growing evil may be checked at once. What would my patients think of me, in the country, if they were to come to my office to get a plate made, and I should say, "Sir, I do not make plates, I am an operator?"

AMERICAN DENTAL ASSOCIATION.

TO THE EDITOR OF THE MISSOURI DENTAL JOURNAL:

At the last meeting of the American Dental Association, which was held at Chicago, the following commitee was appointed for local work: Dr. G. C. Daboll, Geo. L. Field and C. R. Butler.

Unfortunately, the two *ends* of the committee have deemed it advisable to leave the country for a time, leaving the *center* only intact, and I being said center, have made the following arrangements for our next meeting at Niagara Falls:

Grant's Hall has been secured for our meetings. Rates for delegates and their wives will be, at the International Hotel $3.00 per day; at the Cataract House $2.50. These rates include omnibus and baggage to and from the hotels. Rooms at either hotel may be engaged in advance, and those stopping at the International are entitled to a free ticket of admission to Prospect Park during their stay. As to other places of interest at the Falls I would say that no arrangements have been made as yet for a reduction of rates for members of the Association, but I shall make it my business to see what concessions can be obtained.

In railroad matters I have not succeeded in doing much. The New York and Erie will give their agents at Newark and Patterson instructions to sell excursion tickets to the Falls and return, good for the term of the Association, at $16.00. Mr. Ab-

bott also writes me that he will give reduced rates from other stations on the road. Those wishing to pass over this road would do well to correspond with Mr. John N. Abbott, General Passenger Agent, New York, at an early date. The Canada Southern and Great Western roads of Canada will sell tickets over their lines at half rates. The Toledo and Wabash road will do the same. *In all* cases the delegates will be required to present to the ticket agent a certificate from either the President or Secretary of the Society he represents, certifying that he is a proper person to receive said reduction. These certificates can be obtained by the Society officers of the general ticket agent of the above mentioned roads. Michigan roads will make no reduction. If the Association met *in* that State half rates might be secured. I shall make no further effort in railroad matters, as it will be better for members living near one locality to make their own arrangements and secure concessions for themselves. And again, if I should be *too* successful in this committee work, I might be placed in a similar position again, and as this year will bring honors sufficient, I wish no more.

Respectfully, Geo. L. Field
Local Committee A. D. A.

AMERICAN DENTISTRY IN PARIS.

Some few months since we announced the opening of a dental office in the city of Paris, by American dentists, Drs. Daboll, Cook, Bogue and Moffett. It is with pleasure that we learn that they are meeting with a merited success.

A lady formerly a patient of ours, writes us that she recently visited a confrère there for the purpose of having some dental work done. Dr. Daboll being in attendance, took charge of the case and waited upon the lady—as she expresses it "in true American style, doing his work in a very satisfactory manner."

We shall take the liberty of giving our readers some few extracts from her letter: "Dr. Daboll works quite rapidly, doing good and thorough work, in a shorter time, and with *less* assist-

ance than any operator I ever saw. He uses the automatic mallet-plugger, and does it so well, that he has quite converted me. The blow is rapid and infinitely preferable, however hard, to that of any mallet ever used for me. He uses Pack's cylinders, beginning his filling with them unannealed, finishing with those annealed (by radiation.) He makes constant use of that abomination, the rubber dam, and the dam clamp. For a cavity on the posterior surface of a molar, he used a matrix, wedging the matrix against the tooth, and then building his filling up against it, making a beautiful operation. The most interesting instrument in his operating room, the most wonderful, the greatest invention of the age—one which robs the dental chair of half its terrors, is the "saliva ejector," (I believe that is the name.) Perhaps you have seen them, perhaps you have one; if not, you should get one at once, if you have any regard for the comfort of your patient. The rubber dam is adjusted; it is fastened back; then a very diminutive napkin is folded and pinned to the dam covering the chin; a small nickel plated ball with chain attached is hooked through the dam to hold it down; a small glass tube bent to fit over the teeth and lips is slipped in the opposite corner of the mouth from where the dam is adjusted, and there you are.

Comfort? I can assure you it is really delightful compared with former operations of this character which I have undergone. No choking, no stuffing of napkins into our collar, and then feeling the warm liquid slide over the lips, chin, neck, collar, cravat, dress, everything. No hurry for the dentist; no seeing the saliva well up through an unsuspected hole in the dam, deluging a half-finished filling! Not a bit of it, for there goes the saliva running down this tube. The patient with dry face, not suffocated with napkins—mouth always comfortably dry—can hear the drip, drip, as the water carries it into the spittoon or reservoir made to receive it, while the operator works on without that haste and anxiety which is so wearing, feeling that his patient is comfortable and in no danger of strangling to death. The instrument is rather ornamental, with its two glass globes and long silver-plated tube. But 'tis hardly necessary for me to describe them, for you must have seen them, being an American invention, Dr. Snow, of Buffalo, the inventor.

The doctor tells me he has all he can do at 40 f. ($8.00) per hour. He leaves in July, Dr. Bogue, of New York, coming to take his place. Whenever you have patients coming to Paris you can recommend Dr. Daboll and his associates, who, I feel confident, will serve them faithfully and at reasonable rates.

Dr. Barrett, of Washington City, D. C., now located in Paris, has a most delightful office, and as we learn from traveling Americans, enjoys an extensive and lucrative practice among the better class of Parisians and sight-seeing Bohemians."

RHODE ISLAND DENTAL ASSOCIATION.

At the organization of the Rhode Island Dental Association, in the city of Providence, on the first Tuesday of July, 1878, the following officers were elected for one year:

President—Dr. A. W. Buckland, of Woonsocket; Vice-president—Dr. H. F. Marshall, of Providence; Secretary—Dr. L. L. Buckland, of Providence; Treasurer—Dr. Wm. P. Church, of Providence.

Dr. Wm. Barker—at whose rooms the Association met—read a paper upon the Care and Treatment of the Deciduous Teeth.

Arrangements were perfected for the holding of meetings on the first Tuesday evening of each month.

L. L. BUCKLAND, Sec.

DR. WATT'S PAPER.

The paper, by Dr. Watt, published in our June number, was read before the Ohio State Dental Society, and should have been credited to the published transactions of that Society.

PYORRHŒA ALVEOLARIS.—A CASE IN PRACTICE.

Mrs. M———, thirty-five years; nervo-sanguine temperament; general health good: called for consultation in regard to her teeth and gums, which were causing her much pain and uneasiness.

HISTORY OF THE CASE.—She had been troubled for several months with an uneasy feeling, sometimes amounting to pain in the gums and teeth of both the upper and lower jaw. The teeth would at times appear elongated; become quite loose and painful, especially to the touch. The gums swollen and tender, bleeding readily, so as to interfere with her customary use of the brush. Was troubled with a disagreeable taste, and fetor of the breath, especially on rising in the morning. Had received some treatment, consisting of mouth washes, hypodermic injections of aromatic sulphuric acid in the borders of the gums, but with no apparent benefit. Through the advice of her dentist she had recently had the first and second left lower molars which, were very loose and painful, extracted, with the hope of relieving her of pain, and of arresting disease. The third molar was now troubling her as the others had, and she desired to know if anything could be done for her relief without the loss of this tooth.

On examination, I found the teeth, which evidently had been well cared for, all more or less loose, and painful on percussion. This was especially the case with the tooth complained of—the third left lower molar—and the molars and bicuspids of the opposite side; the central incisors of the lower jaw, and the left central and lateral of the upper, and the molar and bicuspids on the right side, upper.

The gums were of a dark livid color; lax, and very much thickened, especially at the gingival border, which was deeply festered. Being deprived of a part of the epithelial structure, the surface had a polished look, and bled easily; at some points, as at the anterior border of the incisors; the gum was entirely denuded of its epithelium and the surface had become granulous, covered with fleshy buds, small nippled vegetations, bathed by a

peculiar oozing, as frequently seen on the granulating surface of a wound. The characteristics of fungous gingivitis. An examination with an exploring instrument, which could be readily passed underneath the gum nearly to the apex of the roots of several of the teeth, revealed a ring of hard, nodulated, rough, dark brown deposit on the roots of the teeth beneath the gum; this deposit was found to reach nearly to the border of the alveoli, from the ulcerating surfaces of which pus was constantly being thrown off. We have here a well marked case—as I understand it, of what has been designated as "Riggs' disease," or Pyorrhœa Alveolaris. It is in fact, a case of ulceration of the alveolar border, induced or kept up by this ring of deposit around the necks of the teeth. The etiology of the case is at present somewhat obscure, and has not, we believe, been very definitely settled.

There are several constitutional disturbances which might induce ulceration of this bony tissue, and when once set up, the rough deposit soon takes place, which in turn serves to maintain the ulcerative process, and consequent loss of the alveoli; thus the first step in the treatment is clearly indicated, viz: — the perfect removal of this deposit from the necks of the teeth. With instruments similar to those suggested by Dr. Riggs, we removed as perfectly as possible, all the deposit at the first sitting. Chloride of zinc in crystal was applied to the ulcerating surfaces by passing it under the gum around the teeth on a little cotton wound on a broach. Tincture of Iodine, full strength, was used as a topical dressing; a tonic and astringent mouth wash with potassium chlorate, was recommended to be used after each meal, and at night, with as thorough use of the brush as the condition of the gums would allow. The first application of the zinc gave little or no pain. On the second day, the teeth were again thoroughly examined for any remaning particles of deposit, and the zinc and iodine again used; some pain, followed this application, lasting but a few moments. This treatment was repeated daily for six days, omitted on the seventh and renewed on the eighth and ninth, when the patient left the city. The improvement following this treatment was very marked; the gums had assumed a normal color and appearance; the teeth ceased to be

painful on percusion, and had became firmer as the tonicity of the peridental membrane was restored; hemorrhage from the gums, and the secretions of pus from the ulcerating borders of the alveoli had ceased almost entirely. The disagreeable fetor, one of the worst features in this case, had also disappeared. What the final result of the case has been, we cannot say, as the patient has not been heard from since she left the city, but we feel confident, judging from the result following this treatment in various similar cases, that if thoroughly carried out in this case, the disease has not only been arrested, but the hard and soft part alike restored to a healthy normal condition. Our experience with the chloride of zinc in these cases has been much more satisfactory than other treatment. E.

Editorial.

MISSOURI STATE DENTAL ASSOCIATION.

The Fourteenth Annual Meeting of the Missouri State Dental Association was held at Sweet Springs, Saline Co., Missouri, June 4th, 1878.

No better place could have been selected for holding a meeting of this character.

The location is central and easy of access, the surroundings delightful, accommodations ample and the *table d' hote* first class. No noise or other disturbing influences to detract from the interest of the sessions, and yet, notwithstanding all these advantageous circumstances, we are forced to admit that the Fourteenth meeting of the M. S. D. Association was not a success in a professional point of view;—that in fact there was less real work done at this meeting than any previous one since its organization. It was a decidedly pleasant meeting, and the physical enjoyment of the three or four days spent at this pleasant retreat, free from the care, anxiety, and drudgery of the office, seemed ample com-

pensation for the time and expense incurred. We heard many complaints of the absence of members and the want of interest in these meetings which members of the profession manifested. The attendance on this meeting was small, especially of those who, heretofore, have taken an active part, and were always ready to respond to a call for a speech or a clinic.

At the meeting in 1877 questions for discussion at this meeting were selected and members appointed to prepare essays on the subjectsselected: two of those appointed, came to this meeting prepared to fulfill the duty assigned them. Clinical operators were also appointed, that they might come prepared with suitable instruments, &c., and be ready to do the work assigned them, and yet but few of these gentlemen seemed to recognize any obligation in this appointment; no one came fully prepared to give a clinic. The Executive Committee appointed at the meeting in 1877, and from whom much was expected, from force of circumstances was almost a failure; hence the Association was not in good working order, and accomplished but little. We are at a loss for the cause of this seeming apathy on the part of the profession of Missouri. They seem to have "lost their grip," and given the interest and practice of the profession into the hands of the scalawags and advertising cheap quacks. We feel assured that the leading men of the profession in Missouri desire the advance and elevation of the profession as much as do those of other states, and that they would do as much toward that end, if their efforts were seconded by the mass of the profession throughout the State. Any step in advance which serves to elevate the profession in the eyes of the people, elevates alike the individual members of it. And anything that degrades the profession, injures to a certain extent each individual member. No man can truly and justly say he has no interest in Dental Associations or other means put forth for the advance of the profession, or that they never benefitted him. Neither has any man the right to disregard the ethics of the profession, if by so doing they help to lower the standard and injure their brother dentists.

There is no greater agent used for the elevation of any profession, individually or collectively, than Associations, where men meet on common ground, with one purpose, and for a free interchange of ideas. It was mainly through this means that the veil

of secrecy which in times past hid dentistry from view, and rendered it unrecognizable—was thrown aside, opening the doors of the operating room and laboratory for the dissemination of practical ideas. We have but to observe the results in other States, where associate effort is recognized as the great means to be used in the elevation of the status of dentistry, to know its value, and recognize how much the profession of Missouri is loosing by not taking more interest in our State Association. Illinois organized a State Society in 1865, with a few earnest and faithful workers. This Society has grown to be one of the best in the States, and her profession is in advance of that of any of her sister States. The leading men of that Society, the men who have worked hard for the elevation of the profession, and to make it what it is, are among the leading men of the profession. Many of these men acknowledge their indebtedness to the Society for their advance in professional standing, and their ability as operators. In proportion as the individual members of the profession are elevated and refined, in just that proportion is the status of the profession elevated.

We believe that these statements will not be disputed by any one, and yet our State Meeting must prove a failure for want of attendance and interest. These Annual Meetings can and should be made a power in the land, of such value that no member having any regard for his professional standing could afford to be absent.

To accomplish this end members appointed to certain duties must work, and come prepared to fulfill these obligations, and every individual member should work as if the success of the meeting depended on him alone.

We hope to see a better meeting in '79—and we feel quite confident we shall.

The Executive Committee of the ensuing year is composed of active workers, who have pledged themselves to do their duty, and if other members will respond to their calls, the next meeting of the Missouri State Dental Association will be a success. So mote it be. E.

RUBBER LITIGATION.

We have received from Dr. R. Finley Hunt, of Washington, D. C., a circular giving a concise account of the present condition of the "Rubber Litigation." The names attached to the circular should give weight to the statements contained in it.

We learn from it that the defendants in certain cases now pending in Maryland and the District of Columbia, have placed on record proofs establishing the following points:

1st. Want of novelty, as there was a patent granted prior to 1852, anticipating Cummings in his alleged invention.

2nd. That prior to 1852 dental plates of hard rubber were made by other parties.

3rd. That he did not invent what he claimed, as he paid an agent to instruct him, about 1862, in the mode and process of making dental plates of hard rubber.

4th. Complete abandonment of his alleged invention after the rejection of his application by the Patent Office in 1856.

These proofs, which the circular says have never before been properly presented to the courts, must be fatal to the Cummings patent. This matter is recommended to the consideration of every dentist, as further pecuniary aid, comparatively small, is needed to complete the defence which seems to be so strong as to insure success, and the issue is of interest and importance to the whole profession.

Copies of the circular can be obtained by applying to this office, or to Dr. Hunt. E.

The excessive heat of this month has interfered with the working of our presss-room, causing the delay of this issue.

Books and Pamphlets Received.

INSTRUCTIONS FOR MANUFACTURING THE CELLULOID BASE. With testimonials from parties using it, and other information. Celluloid Manufacturing Company, Newark, N. J.

THIRTY-THIRD ANNUAL ANNOUNCEMENT of the Ohio College of Dental Surgery.—Session of 1878–79. Cincinnati, Ohio.

TRANSACTIONS OF THE NEW YORK ODONTOLOGICAL SOCIETY for 1877. S. S. WHITE. Philadelphia.

PREMIUM LIST OF THE KANSAS CITY EXPOSITION for 1878. September, 16, 17, 18, 19, 20 and 21. $20,000 in premiums. *Open to the World.*

THE ANNUAL ANNOUNCEMENT OF THE DEPARTMENT OF MEDICINE AND SURGERY OF THE UNIVERSITY OF MICHIGAN for 1878–79. Ann Arbor, Mich.

THE SOFT PALATE. Its value in diagnoses, as compared with the tongue in derangements of the liver, malarial diseases and exanthematous fevers. By PROF. WM. ABRAM LOVE, Atlanta, Ga. Reprint from the Transactions of the Medical Association of Georgia. 1878.

Scraps, Notes and Queries.

PERCENTAGE OF MERCURY.—Amalgam, as an almost invariable rule, comains generally twice and sometimes five or six times the quantity of mercury necessary or advisable. This excess of mercury is a great evil, as it not only interferes seriously with the results so far as permanence is concerned, but very greatly increases the discoloration. There is no greater difficulty in using a small proportion than a large one, it is merely a question

of habit. The difference in results can be readily seen by packing two plugs in glass cavities with wet sides, one with a very small, and one with a larger proportion of mercury. The latter will eventually fail in its adaptation, in almost every case, if the surface of the plug is kept covered with water or ink. It does not of necessity fail if kept dry, as the interference of moisture is the principal if not the only cause of change of shape.

No material shows more clearly than amalgam, the tact of a good operator, and his knowledge of the conditions necessary for success; and no material gives, in average dificult cases, such uniformly good and permanent results *provided these conditions are adhered to.* Results are always in proportion to the judgment and skill exercised; if this were not the case skilled operators would be unnecessary. It is easy to satisfy ourselves as to whether a certain system will or will not make a plug which will be a permanent fit to a cavity, under such conditions met with in the mouth, and a system which will fail in theoretica' testing is not very likely to succeed in the mouth. The dirty, offensive looking productions graced by the name of amalgam plugs, which are usually seen, bear no resemblance to a proper amalgam plug, inserted with ordinary care, under the conditions given above.—*Ibid.*

An Incident in Practice.—A gentleman called with his mother-in-law, aged about fifty-five, and her daughter perhaps nineteen years of age, and quite prepossessing. The mother wished a tooth examined which had a filling in it, and she said "the food seemed to stick to it." After carefully searching for the cause of the sticking I began to examine the rest of her teeth, which were remarkably well preserved for one of her age, when she suddenly interrupted my search and said she "thought there was nothing decayed in her mouth," then gave way to the daughter, taking a seat near my chair, a look of disappointment overshadowing her face, such as might come over the face of one who had suddenly realized that their life had been a failure.

I went through the examination of the daughter's teeth, which had never been marred by a dentist, and found only two small cavities of decay. The deciduous canines were in the place that should have been occupied by the permanent ones. I

remarked to her that such was the case, and then turned to the mother and said that such was also the case with one of her eye teeth. Then what a change came over her face! She looked at least ten years younger and as bright and smiling as May. This has a moral, never neglect your mother-in-law, nor any other man's. J. G. H.

HOW TO OBTAIN UNIFORM SUCCESS WITH AMALGAMS.—To obtain plugs uniformly perfect in all points, the exclusion of every trace of moisture is a first and absolute necessity. For the very short time required, this can be obtained with ease without the rubber dam, by using to the walls of the cavity, and also to the edges of the plug, a thin solution of gum copal in ether. If the rubber dam is not used this precaution ought never to be omitted, and any operator who has once seen the results obtained would consider it a necessity. Where this cannot be done, use the amalgam as hard as possible, packing and burnishing until hard enough for mastication; *do not allow moisture to remain in contact with a soft plug.* Neglect of this invariably entails either discoloration of dentine, raised edges, or total failure, according to the properties of the alloy used.

If an amalgam will not harden in ten minutes do not expect perfect results without a total exclusion of moisture. Precipitated Copper and Silver amalgams will make permanent plugs notwithstanding their slowness in setting, but if not perfectly protected from moisture until hard, will cause great discoloration.

Before inserting the body of the plug, work a portion over the whole surface of the cavity with a ball-headed burnisher, to obtain perfect contact with the walls, and use pluggers always more or less round on the surface, never flat, as a flat face condenses only in one direction, generally at the same time disturbing the whole of the other part of the plug.—*Fletcher.*

THE MISSOURI

DENTAL JOURNAL,

A MONTHLY RECORD OF DENTAL SCIENCE AND ART.

VOL. X.——AUGUST, 1878.——No. 8.

SALUTATORY.

With this issue the MISSOURI DENTAL JOURNAL appears under a new management.

Its editorial columns and its general business will be conducted with a view of serving the best interests of its subscribers, its contributors and its advertising patrons.

Its pages will be open to the full and free discussion of all topics relating to dental science and art; and in its advertising columns all legitimate and relevant matter will be admitted.

The large and widely extended circulation which this journal has already acquired should be credited to the ability with which it has been edited, and the liberality of its publishers. Although owned and published, for many years, by a house that has long occupied a leading position in the trade, its advertising department has been but sparsely used by the firm, for the advancement of its own business.

The JOURNAL proposes to be cosmopolitan, in the fullest sense that this term can be applied to dentistry, admitting alike all shades of opinion upon scientific and educational subjects, as well as those that relate to different modes of practice.

Discoveries and improvements in dentistry, whether they relate to science, surgery or mechanism will be judged of with the utmost fairness, and spoken of with strict impartiality.

Messrs. A. M. LESLIE & Co. will continue the publication until the close of the current year, at which time the entire management of the JOURNAL will be assumed by the undersigned.

C. W. SPALDING.

AMERICAN DENTAL ASSOCIATION.—EIGHTEENTH ANNUAL SESSION.

The Eighteenth Annual Meeting of the American Dental Association opened at Niagara Falls, on Tuesday, August 6th, at 10 A. M., the President, Dr. F. H. Rehwinkle, of Chillicothe, Ohio, in the chair. Dr. M. S. Dean, of Chicago, Recording Secretary, and Dr. W. H. Goddard, of Louisville, Kentucky, Treasurer. The proceedings were opened with prayer by Dr. W. H. Morgan, of Nashville, Tenn.

Dr. J. J. Birge, of San Francisco, tendered his resignation, which was accepted.

Dr. G. H. Cushing, of Chicago, offered the following resolution, which was adopted.

Resolved, That dentists not residents in the United States who may be present and whose names may be approved by the Executive Committee, are hereby invited to seats upon the floor, and to participate in the discussions.

Subsequently a resolution was passed inviting physicians and dentists not members of the Association to take seats on the floor.

The Corresponding Secretary, Dr. Marshall H. Webb, of Pensylvania, made the following report:

Your Corresponding Secretary would respectfully report that he has attended to the duties assigned him, notified the gentlemen who were elected honorary members of the Association, viz: John Tomes, M. R. C. S.; Charles S. Tomes, M. A., M. R. C. S.; J. Smith Turner, M. R. C. S.; George Van Langadorff.

D. D. S.; E. Magitot, M. D.; Adolph Peterman, D. D. S.; Mordant Stevens, M. D., D. D. S., M. R. C. S. and Mr. Wedl. A reply has been received from each of the gentleman named excepting John Tomes.

In compliance with the resolution passed at the last meeting of the Association, your Corresponding Secretary, in connection with Prof. McQuillen, has seen to the getting up of a certificate of membership, a copy of which is here presented.

Marshall H. Webb, Cor. Secretary.

The amendment to the Constitution proposed last year, limiting membership in the Association to delegates from State societies and colleges was rejected.

An amendment changing the ratio of representatives from *local* societies from one delegate for every five members, to one for every ten members, was adopted. The effect of this amendment will decrease the representation from local societies, and to that extent lessen the membership of the Association.

Dr. R. W. Hunt, of Washington, D. C., presented the majority report of the Special Committee on Sections.

A minority report from same committee, was afterwards made by Dr. L. D. Shepard, of Boston, and the recommendations therein contained, were finally adopted by the Association.

The report as adopted is as follows:

The undersigned members of the Committee on Sections, did not sign the report with the majority, for various reasons:

They were and are in doubt as to the wisdom of dividing the Associations into sections, but as the opinion of the members in favor seems to predominate, they would recommend that the experiment be tried. They would also recommend that at first the sections should be few in number, and then subdivided as may seem desirable. As a resolution is of no effect in opposition to the Constitution, they beg now to present, without further argument, a minority report in the following draft of amendments to the Constitution:

ARTICLE III.

Sec. 3. Insert the words "and membership of the sections," between the words "to office," at the end of the sixth line, and before the words "none being eligible," at the commencement of the seventh line.

ARTICLE V.

Sec. 6. Strike out the sentence "they shall also report to

the Association upon any and all appliances which may be placed in their hands," near the bottom of the seventh page of the printed Constitution.

ARTICLE V.

SEC. 6, Page 8. Under the head of "third division" strike out the words "names for Standing Committees for the ensuing year" and between the words "they shall report," and "the names of places."

ARTICLE VI.

Strike out all five sections of Article VI, and insert a new article as follows:

SEC. 1. To prepare, arrange and expedite business, this Association shall be divided into six sections as follows:

1. Artificial Dentistry, Metallurgy, and Chemistry.
2. Dental Education.
3. Dental Literature and Nomenclature.
4. Operative Dentistry.
5. Anatomy, Physiology, Histology, Microscopy and Etiology.
6. Pathology, Therapeutics, and Materia Medica.

SEC. 2. It shall be the duty of each permanent member to inform the Recording Secretary, before the close of the morning session of third day of the annual meeting, which of the six sections he elects to join for ensuing year. He shall be free to follow his own preferences as to the particular channel in which he will labor, but can be a member of but one section during the same year.

SEC. 3. It shall be the duty of the Recording Secretary immediately after the close of the above morning session of the third day, to make out lists of the names thus furnished of each section, as a basis for the election of officers of said sections.

SEC. 4. The Association shall, by vote, assign some time after the regular election of officers of the Association, for the meeting of the several sections for organization.

SEC. 5. When the time for the organization of the sections has arrived, it shall be the duty of the Recording Secretary to furnish some one member of each section with the list of members of his respective section, which member shall thereupon call the members to order, and read the list of names. The members shall then elect, by ballot, a Chairman and such other officers as they may see fit.

SEC. 6. The Chairman shall preside at the meeting of his section. Shall exercise general supervision over the business, and shall see that the labors of his section are conducted in the manner calculated to secure the best results. The Chairman, or such other member or members as the section shall select, shall prepare

and read at the annual meeting of the Association next ensuing, a paper or papers on the advance and discoveries of the past year in the branches included in the section. The reading of such papers shall not together occupy more than forty minutes.

SEC. 7. The several sections shall meet at 10 A. M. on the morning of the first day of the annual meeting of the Association.

SEC. 8. For the information of all members, a list of the members of each section shall be published in the transactions of each year.

ARTICLE VIII.

Under "order of business" insert between Nos. 1 and 2 the words two meetings of the sections at 10 A. M.. Change present No. 2 to No. 3, and have it read "Organization of the Association at 11 A. M."

Change No. 3 to 4.

Change No. 4 to 5, and strike out the words "Standing Committees," and insert the word "sections."

Change Nos. 6, 7, and 8, to 7, 8, and 9.

Strike out all of No. 9.

Respectfully submitted,

L. D. SHEPARD,
J. N. CROUSE.

Before final adjournment, the sections were organized, as follows:

Section I., Artificial Dentistry, Metallurgy and Chemistry—Chairman, Dr. R. Finley Hunt, Washington, D. C.; Secretary, Dr. C. S. Stockton, Newark, N. J.

Section II., Dental Education—Chairman, Dr. J. N. Crouse, Chicago.

Section III., Dental Literature and Nomenclature—Chairman, Dr. W. H. Atkinson, New York; Secretary, Dr. J. Tafft, Cincinnati.

Section IV., Operative Dentistry—Chairman, Dr. I. J. Wetherbee, Boston; Secretary, Dr. W. H. Goddard, Louisville, Ky.

Section V., Anatomy, Physiology, Histology, Microscopy and Etiology,—Chairman, Dr. M. S. Dean, Chicago; Secretary, Dr. M. H. Webb, Lancaster, Pa.

Section VI., Pathology, Therapeutics and Materia Medica—Chairman, Dr. F. H. Rehwinkle, Chilicothe, O.; Secretary, Dr. Will Tafft, Cincinnati.

The following amendment to the constitution proposed last year was then taken up and warmly discussed. "No Dental College shall be eligible to representation in this Association which does not require two courses of lectures as a condition of gradu-

ation." Drs. Hunt, H. A. Smith, Rawls, Atkinson, Wetherbee, McQuillen, Spalding, Flagg, Peirce, Buckingham, Morgan, Abbott, McKellops, Shepard, McDonald and Cushing took part in the discussion. A large majority expressing themselves in opposition to the proposed amendment. Several speakers favored the adoption by the Association of a minimum standard of qualifications requisite for graduation, but were opposed to the fixing of an arbitrary rule as to time. On motion of Dr. Cushing the subject was referred to a committee of three. On a subseqent day the committee reported the following resolution as a substitute for the proposed amendment :

Resolved, That this Association disapprove of the practice of Dental Colleges in graduating upon less than two full courses of lectures, and believe it to be detrimental to the interests of dental education, and advise the omission of such inducements from their annual announcements.

Dr. M. S. Dean, of Chicago, chairman of the Committee on Physiology, read a very interesting report giving the history and present status of some vexed physiological questions, which may be summed up as follows :

The rudimentary or abortive dental organs of the ruminants; the developments of the enamel; the determination of the form and character of the future tooth, etc.

Dr. Dean is perfectly at home in this branch of dental science, and his comparisons of the views of different authors who have written upon these subjects were very clearly drawn and commanded the close attention of every member present.

He cited the statement of Goodsir that in ruminants, where the upper front teeth are wanting, undeveloped germs of these teeth were found in the upper jaws. He said that recent observers have failed to confirm these statements of Goodsir, and hence the theory of the existence of these tooth germs must be vigorously verified or abandoned altogether.

In view of the obstacles to the development of a third set of teeth, that are known to exist, and notably the absence of tooth germs from which a third set might be produced, and the condition of the alveolar borders which are so markedly unfavorable to the production of new teeth, the writer concluded that third dentition, so-called, was nothing more than the tardy eruption

of a few normal or supernumerary teeth. The cases heretofore reported had not been examined with scientific care. In this connection he called attention to the tendency of scientific men to be led into discrepancies regarding the teeth; as an example of this he quotes a case reported by Darwin of a woman having an unusul growth of hair upon the face and other surfaces, and having also a double row of teeth in both jaws. A careful examination of this case revealed no double row but a deficient denture, there being only twenty-five teeth in all, accompanied, however, by a hypertrophy of the alveolar ridges.

Scientific men are liable to be mistaken on these points, and for this reason, and if for no other, dentists should investigate all cases putting forth such extraordinary claims.

The view of Dr. Magitot relative to the part played by the enamel organ in the process of tooth formation was quite fully presented. Dr. Magitot claims that the enamel organ controls the form of the future crown of the tooth, instead of the papilla, as has been generally supposed.

Dr. Dean said that the fact (as was generally believed,) that a *permanent* bicuspid and a *temporary* molar—teeth so dissimilar in form—were both developed from one and the same epithelial cord, would militate against this theory. If this cord determined the *form* of the future tooth, one would naturally suppose that these teeth would possess a similar form.

But on examining this subject more carefully, he stated that he had found much that strongly supported, as he believed, the theory of Dr. Magitot. He said, if the theory of Dursey was correct (and he had no knowledge of its being disputed) that "a semi-lunar area" extends the entire length of the jaws, from which the dentine papillæ may be developed, we might conclude that there was no special point from which a papilla is to be developed; and that its origin, and place of origin must be entirely dependent upon the *presence* and *influence* of the enamel organ. At whatever point then in this papillary(?) area, the enamel organ—of a cuspid tooth for example—should appear, a papilla of a cuspid tooth would originate; and if, on the contrary, the enamel organ of a molar tooth had come into contact with the same point, the result would have been the development of a molar instead of a cuspid tooth.

If this be true, the enamel organ must determine both the *place* of origin and the *form* of the future tooth.

The enamel organ is wholly epithelial. Opinions are divided as to the method according to which the process of calcification goes on, which results in the production of enamel. Whether the enamel cells are themselves calcified, and thus converted into enamel prisms, or whether the enamel is the result or an exudation or secretion from these cells, that is afterwards calcified, is yet undetermined.

Dr. Atkinson said that histology must first be understood before much can be known of physiology. Will show at another time what gives direction and form to the teeth. The term cell should not be employed in this connection. Embryonal corpuscles, and not cells, are called into activity; and from these the enamel is formed. He classified tooth substance as follows: Enamel, epidermal; dentine, dermal; pulp, sub-dermal, or ordinary animal tissue.

Rings around the teeth are caused by the presence at this depressed point of embryonal corpuscles that are incapable of being calcified. Lumps at the necks of the teeth consist of masses of calcified embryonal corpuscles that were in excess.

Prof. J. H. McQuillen read a paper on the restoration of the cerebral functions in a pigeon, after four-fifths of the cerebrum had been amputated. Dr. McQuillen stated that the usual phenomena attendant upon the operation followed, in profound stupor, the bird standing motionless on the table, with eyes closed, the head sunk between the shoulders, and the feathers ruffled. When pushed, it opened its eyes and moved the body, and when thrown into the air it flew a few feet and then, on alighting, relapsed into somnolency with an evident obliviousness to surrounding objects until again aroused by handling. By the first of March, 1878, about twenty-three days after the operation, I was surprised at the complete recovery of the voluntary movements of walking and flying, the general manifestation of intelligence and the fact of feeding itself and drinking as usual. I asked then, and I repeat now the same question: how are we to account for the restoration of these functions? Is it due to the fact that the small amount of cerebrum left after the operation, assumed the functions of the entire organ, or has there been a regeneration of

the part removed? There is but one other case on record that I have met with, where there has been a recovery of voluntary action on the part of a pigeon from which the cerebral hemispheres had been removed; and I was not aware of the fact until the experience with my pigeon induced me to make a careful examination of the literature of the subject. It must be remembered, I only cut the upper four-fifths of the cerebrum. In doing this, however, the superficial grey matter of the hemispheres, generally recognized as the structure physiologically concerned in the exercise of the faculties of attention, perception, memory and will, was removed. Six months after the operation the pigeon which survived the vivisection was put to death under chloroform and a *post mortem* examination made. On removing the scalp a fibrous structure was found analogous to the pericranium, and on opening this a small amount of serous fluid escaped. When the cranial cavity was exposed, he found a large amount of white substance which he inferred was generated from the unremoved portion of the cerebrum. He placed a section of it under the microscope and discovered that it held ray shaped cells, characteristic of nervous structure. There were those who opposed vivisection, saying "we have learned all we can, don t torture animals any more." Dr. McQuillen thought his experience had taught him that there was yet much to learn in order that dentists, as the alleviators of human suffering, might appreciate what was expected of them, and be stimulated to govern themselves accordingly.

We can have no better evidence, said the speaker, of the necessity of experimental investigation in the nervous system, than was presented by the statements of Prof. Brown-Sequard, the distinguished scientist, who has succeeded to the chair held by Claude Bernard in Paris: that most of the conclusions of physiologists and pathologists, in this direction, are founded in error. As he has said, the superstructure is not built upon the rock, but on the sand, and that it is tumbling about our ears.

Dr. Black, of Jacksonville, Illinois, made a very interesting report on odontoblasts. He said the question of the regeneration of these cells is a very important matter. They are cylindrical in shape, having prolongations extending outwards, and also lateral processes. They constitute a distinct layer covering

the entire surface of the pulp. They are special cells; and the more distinctly a cell is specialized, the less the probability of its being reproduced. Dr. B. concludes that when the odontoblasts are destroyed they are not reproduced.

Prof. Peirce, of Philadelphia, read a paper on the mechanical modifications of the teeth arising from the motions of the jaws. He showed from illustrations in comparative anatomy the progressive development of variety in the motion of the jaws. In the earlier types the jaws simply open and close, being devoid of lateral motion. In more advanced types lateral movements appear, motion being fully developed in the ruminants.

In speaking of the causes of dental caries, Dr. Peirce mentioned lack of use in comminuting hard and tough substances. Hence when there is a hereditary predisposition to decay. Soft food favors its occurrence.

The general report of the Committee on Histology and Microscopy, which was made by Dr. Peirce, contained the important announcement that W. R. Gowans, of London, England, had perfected an instrument for the counting of blood corpuscles. By the use of this instrument he has determined that the disproportion between the number of the red and white blood corpuscles is greater than has heretofore been supposed, being in the ratio of about 400 of red to 1 of white, instead of 300 to 1, as is commonly asserted.

The same report also contained some new views on the tonic effects of iron in the blood, which views result from experiments and observations made by Dr. Gowans. He had found the use of iron to greatly increase the number of the red blood corpuscles without any preceptible improvement in the health, even when the number of corpuscles was enormously multiplied. This augmentation of the number of red corpuscles was found to be useless, unless accompanied by a corresponding increase in the amount of hemi-globine in the blood. The general report contained other interesting and important matters, and concluded with a reference to the great value to dentists of a more systematic and thorough training in the collateral branches of science, not directly connected with their manipulative work. Such knowledge would enable them to deal more successfully with those stubborn anæmic cases which are so productive of nervous

diseases. Dr. P. called attention to several improvements in the microscope, stating also that the last twelve months was especially noted for the introduction of superior microscopical instruments at greatly reduced prices.

Dr. W. H. Atkinson followed Dr. Peirce and read a valuable paper on the preparation of specimens for the microscope; histological structure of the teeth and dento-genesis, by Dr. C. F. W. Bödecker, of New York, a non-member of the Association. The paper showed industrious research on the part of its author, and presented some rather new views upon certain undetermined points in dental histology.

No synopsis of this paper was made.

Dr. G. F. Waters, of Boston, Mass., from the committee on Histology and Microscopy, gave the result of recent investigations into the character and production of fungi; speaking specifically, of fungous growths upon the teeth.

Owing to a sudden illness Dr. W. was compelled to discontinue his remarks. We trust he will write them out in full for publication in the Annual Transactions of the Association.

Prof. Buckingham, of Philadelphia, gave his views on the formation and growth of dentine. He regards odontoblast as an extension of the formative organ of dentine, that is, that the odontoblast belongs to the dentine, rather than to the pulp, as is usually held. Hence, as the calcification of dentine proceeds from without inwards, the odontoblast is pushed onward in front of the advancing dentine. He claims that a column of dentine is formed from a single cell—the odontoblast—which is fed from the pulp and is constantly encroaching upon the soft tissue of which the pulp is composed. In case of a fracture of bone, the osteoblasts spring from the broken surfaces, and the bone grows from both sides until the gap is closed. So it is with the growth of dentine. The odontoblasts are not themselves calcified; they are permanent organs. The calcifying substance is deposited in germinal matter secreted by the odontoblasts.

Dr. Atkinson claimed that those who had not studied the developments in histological science which have been made in the last ten years, had no right to an opinion on the subject.

He said that crystals belonged to the minerals, cells to veg-

etables and colloid bodies to animals; and that there were no cells in animals except such as are of vegetative growth. Hence the term cell should no longer be used in speaking of animal tissues.

In speaking of the papers of Drs. Black and Bödecker, Dr. McQuillen claimed the fibrilli passing into the tubuli of dentine were shown by Dr. Black in Chicago last year; and consequently the claim that Dr. Bödecker had for the first time discovered the fibrilli extending into the tubuli, is not well founded.

Dr. Black said that Dr. Bödecker had applied the theory of Carl Heintzmann to the histology of the teeth. Is not yet ready to accept the theory of Carl Heintzman as applied by Dr. Bödecker. It may be true, and in the future we may be compelled to accept it, but with the evidence that we now have before us, is disposed to question the conclusions of Dr. Bödecker.

Dr. Atkinson said that the old authors do not give the explanation first given by Heintzman and afterwards by Bödecker, consequently he claimed that their views were new.

Dr. Atkinson then read his report on pathology. Some discussion ensued between Drs. Spalding and Atkinson on the character of pus. Dr. S. dissenting from the view of Dr. A. that pus was simply dead blood.

Dr. George A Friederichs, of New Orleans, presented a very animated report of Dental Education. He held that the day when dentists could be qualified by private tuition had gone by; that the public and the profession now demand a collegiate education in dentistry. Dentistry being a specialty, should be taught by specialists who are in actual practice; but a medical course ought to precede the dental. He recommended that the President of the Association be authorized to appoint a committee of one at every place where a dental college is located to report to the Association the advantages possessed by such institution for the practical teaching of the science and art of dentistry.

Dr. Thomas Fillebrown, of Portland, Maine, made the second report on Education. He advocated the teaching of dentistry exclusively in medical schools, and gave as a reason that more schools are needed, in order that the facilities for obtaining an education may be more widely distributed. Another reason was that where professional schools were established a higher stand-

ard of professional attainment would prevail. Dr. F. favors the abolition of the degree of D. D. S. and the granting of the degree of M. D. alike to medical and dental graduates. In that case, he says, if a student makes a mistake in entering the practice of dentistry, being not well fitted by natural abilities for it, he may, if medically educated, correct his error by seeking some other branch of practice. And the contrary was also true. Many a poor doctor, with surgical talent, but no opportunity to use it, might become a brilliant dentist. Dentistry as a specialty of medicine was, perhaps, more distinctly a branch of surgery, but in either case, distinctly medical. When physicians know as much about dentistry as they should, and when dentists were equally well informed with reference to medicine, all questions about recognition or mutual respect would cease to be raised, and "there would be no sickly sentimentality about claiming fellowship with a fellowship that disclaims us, for all will be of one family, owning the same *Alma Mater* and laboring for the common good—the amelioration of human suffering and the elevation of the human race."

In concluding his report Dr. Fillebrown offered the following preamble and resolution:

Whereas, Dentistry is a specialty of medicine, and requires, as do other specialties, a thorough medical education as preliminary to its most successful study and practice,

Resolved, That we deem it expedient and for the best interests of the practice of dentistry that existing medical schools so enlarge their curriculum as to include efficient instruction in dentistry, and thus make the requirements for graduation the same for this as for other specialties of medicine.

Dr. J. N. Crouse, of Chicago, Ills., made a third report on Education. He proposed that all respectable dental colleges should form an association and adopt certain regulations in regard to dental education, and that the profession at large would endorse as high a standard as they might see fit to adopt. He claimed that dentistry must be regarded as a specialty of medicine, and to make this effectual the student of dentistry should first take the degree of M. D. in a regular school of medicine. He favored an extension of the powers granted to State Examining Boards in those States where such boards exist.

Dr. R. Wilson Hunt, of Washington, D. C., said that the subject of education was of the first importance to the present and future interests of the dental profession. One objection to the proposition contained in the preamble and resolution appended to Dr. Fillebrown's report was that it would put the matter of dental education beyond the control of the dental profession. He said it was a mistake to suppose that medical instruction was not given in dental colleges. The success of a dental, or of a medical college depended not upon the adoption of a set of rules and regulations, but upon the conscientious discharge, by the officers, of the duties and responsibilities resting upon them; and any institution was good or bad in proportion as it was faithfully and properly conducted.

Whether dentistry was a specialty of medicine or not was a subject that did not necessarily connect itself with dental education.

At the conclusion of his remarks, Dr. Hunt gave notice that after the close of the discussion on this subject he should move the reference of the preamble and resolution offered by Dr. Fillebrown to the section on Education.

Dr. L. C. Ingersoll, of Keokuk, Iowa, said that of late years the tendency in all professions had been downward instead of upward. In the effort that is now being made to elevate the dental profession, it seemed to him that the commencement was being made in the centre when it should be made at the beginning. It was elementary more than medical education that was lacking in our present system of dental education. There was too much made of the question of medical instruction and not enough of that pertaining to the elementary. There were young men who commenced the study of medicine who, at the same time, would be found incapable of writing three or four lines of good English. Go back to the old proverb, that "Mind makes the man," and insist on a good mental acumen, and a sufficient preparatory education; he added, "dentistry *is* a specialty of medicine, but the dental profession asked no favors of the medical profession and had been offered none.

Dr. James Taylor, of Cincinnati, Ohio, said that when he beheld the interest that was now being manifested in the subject of dental education, it took his mind back to the time when the first

efforts were made to afford facilities to dental students for obtaining an education at all. Previous to the establishment of the Baltimore College, by Dr. Chapin A. Harris, there were no such facilities existing. When Dr. Harris applied to the medical colleges, asking them to establish dental chairs, the request was refused and the means of dental education denied us, by the medical schools. There was no other course open to us but the institution of independent dental schools. This was done first at Baltimore, and then at Cincinnati. From these beginnings the whole fabric of dental education has been built up. The dental colleges have done the best that they could. They have done well, but they are capable of doing still better. Their present curriculum of study should be enlarged until it comprises all that can be desired for the complete education of the dentist. Dentists should undergo examinations in anatomy, physiology and pathology, equal to those required of medical students. True dental science, was true medical science.

Dr. J. Foster Flagg, of Philadelphia, said that Josh Billings, a well-known and highly esteemed gentleman, had said "they are sensible people who think as we do," and he therefore esteemed the last speaker as a highly sensible gentleman. He was disposed to give the medical colleges a fair trial and see what they could do. Among those that had already organized dental departments was the Harvard University. This was the first and by all means the best; that of the University of Pennsylvania was the last, and it was decidedly the worst.

Dr. John Allen, of New York, expressed himself as delighted with the progress that had been made in the matter of dental education since the time he became a dentist, now nearly half a century. Then there were neither dental schools, nor dental journals, nor societies. He considered a knowledge of medicine essential to the successful practice of dentistry.

Professor Wetherbee, of Boston, desired to add his testimony to the general stock in trade regarding dental education, because it was something which he had taken great pleasure in favoring. After a trial of dental colleges of forty years, some men were desirous of putting the profession out to nurse, and recommended an education in medical colleges. They say that this is necessary to success. It was a lie to say this—that was plain

talk, but people could understand it. Students of dental colleges did not receive the honors of the institution, until they were well up in a knowledge of the several branches which they would pursue in a medical college.

Prof. Darby, of Philadelphia, a representative of the University of Pennsylvania, waiving anything that had been said of the institution that was not complimentary to it, said for the encouragement of those who recommended a medical education, that a majority of the dental students at the University had signified their intention to take the three years course in medicine. Time, he thought, would prove whether the medical education was necessary. The course recommended by Dr. Fillebrown would make a man taking them, forty or fifty years old, before he would be able to do anything; before he had lived more than half his life, he would be getting ready for his grave. Dr. Darby thought a young man should become a graduate in medicine, and then he could practice dentistry if he wished.

Dr. Atkinson said that dentistry was medicine, and that he desired to put this forth as a dogmatic aphorism.

Dr. C. W. Spalding, of the Western College of Dental Surgeons, said there was but one opinion as to whether dentistry was a branch of medicine, and also as to whether a knowledge of medicine was a necessary part of a good dental education. The question *at this time* was, as to how far such a rule could be applied and enforced. All admitted that an education in medicine is desirable, but we cannot reach the desired end, at a single bound. On the other hand we must work towards the attainment of that end, just as far and as fast as circumstances will permit.

If the views put forth by Dr. Fillebrown and some others were carried out, it would sweep away our whole system of education at one stroke—this would be unwise. At present there is great diversity of opinion, as to what had best be done. Let us work on as we are, and wait until there is greater unanimity of thought upon this vital point. Let there be action by this body only so far as can be done with a good degree of harmony. When we see more nearly alike, the way will open clearly before us; till then, let us go slowly. More and more of medicine should be taught in our dental schools until there should be

nothing more to be desired. It is now impracticable to require first a medical and then a dental course.

Dr. McQuillen favored a medical education—the broadest education for a dentist that was practicable at this time. The high standing of American dentists abroad, and the recognition accorded to American dentistry in other lands, was due to the work of the dental colleges. If univesities desired to inaugurate dental departments they should demahd the full course of three years.

Dr. Crouse made a lively attack on what he termed one-horse dental schools, and said no school should be endorsed which did not provide the full course.

The question was then taken on the motion to adopt the preamble and resolution of Dr. Fillebrown, and the same was lost by a vote of 28 to 19, not one-half the members of the Association voting on either side.

Dr. F. M. Odell, of New York, read a lengthy and very interesting report on therapeutics. He asserted that the exalted degree of animal heat which accompanies fever, is caused by either an increased production of heat by the ordinary physiological agencies, or by a decreased diffusion, by radiation, etc.; or by both these causes combined.

He regarded the thermometer as an instrument of great value in determining the existence of an abnormal degree of heat, which constitutes fever. In health, the range of temperature in man is found to be from 94.4° to 99.5° Fahrenheit. If the thermometer indicated a degree of heat either above or below the limits of the above named range; disease may be assumed to exist. The thermometer was also useful in showing any change in the disease, either favorable or unfavorable. It is an important guide in all diseases of this character, and gives the key to the treatment required.

The evolution of animal heat results from the processes of digestion and assimilation or from those of secretion and excretion. This heat is dispersed partly by expiration, and partly by radiation through sudoriferous organs. The activity of the dispersing organs may be increased in a variety of ways. Warm drinks if continued until the sudoriferous glands are excited to increased action, will result in reducing the temperature; in-

creased respiration, or bathing the surface of the body with water and soap, followed by a bath of spirits, will produce like results. Other therapeutic agencies were named by the author, who also discussed to some extent the laws of their action. As it is our purpose to review this important paper after it appears in print, we do not attempt anything like a full summary of its contents in this brief notice.

In discussing Dr. Odell's report Dr. Atkinson asks: What is fever? Fevers, said he, are of only one kind, the difference between them being only a difference in degree, and not in kind.

He also asked, "What is tonicity?" and said, it means the bringing about of a nerve current in the vaso-motor system, acting upon the protoplasm, effecting polarity and depolarity of the protoplasmic mass, thus producing molecular motion in the molecular mass and its constituent atoms.

An even balance in the activity of that mode of motion that we call funtion constitutes health. When this balance is lost or disturbed, therapeutic action is called for, to effect its restoration.

The building up of the tissues goes on at a rate corresponding with the expenditure, when the acid and alkaline elements of our food properly neutralize each other, and the supply of proper material is equal to the demand. But when the supply is deficient, oxygen seizes upon the nitrogenous elements, and the tissues are wasted or destroyed. Drunkards stuff themselves so fully with hydro-carbons, that the tissues are not expended in the production of animal heat; hence they live so long.

Dr. A. distributed sample bottles of salicylic acid and of boracic acid. He advised the application of a solution (alcoholic?) of salicylic acid to all pus producing surfaces until a white sheet has been produced, by the action of the acid upon the albumen. The pure exuded albumen has a closer affinity for the acid, than albumen has in the tissue. When a plate irritates, treat the irritated spot in this manner, and the plate can be worn without inconvenience. To prevent the flowing of the acid solution, and to limit its escharotic action, it is well to cover it with a plaster of tannin and glycerine. For washing out cavities of decay use a saturated solution of salicylic acid in water.

Borcic acid dissolved in water is an admirable disinfectant and may be used as a mouth wash.

The above is a disconnected sketch of the remarks of Dr. A. Any long hand reporter, who has ever attempted to follow Dr. A., knows how difficult it is to give a consecutive report of this rapid talker's remarks.

Dr. M. H. Webb, of Pennsylvania, read a very long report on operative dentistry. So comprehensive was this paper, that it might with propriety be called a synopsis of an entire course of instruction on dental surgery. We have not attempted to do more than to present a few of the many points which the paper contained, and these are given in a somewhat disjointed manner.

Dr. Webb said that absorption of the roots of deciduous teeth does not take place after the death of the pulps. Disintegrated or partly decomposed spots on the enamel should be polished off; and if white or light colored spots remain, they should be removed, and the cavities caused by their removal filled; for the reason that polishing is not likely to be successful in these cases.

He is opposed to permanent separations of the teeth.

Considers light (thin) foil the best, for the reason that it is easily adapted to the walls of cavities. The greater number of mallet blows necessary to condense heavy foil is liable to damage the walls. Prefers the electric mallet if *intelligently* used. Cohesive gold only should be used when the mallet is employed. Prefers the folded form, cut into small squares. If the gold moves in the cavity it must at once be removed. In his hands, the blows of the electric mallet can be graduated as easily as can the light and heavy strokes of a pen.

The rubber dam can be applied in *all* cases, and is best secured by a ligature of waxed floss silk. When clamps are used they should be first adjusted, and the dam drawn over tooth and clamp afterwards.

In preparing cavities, a slight under cut should be made at about the line of junction of the dentine with the enamel. This ensures strength of margin, but no groove is admissible in the cervical wall by reason of the thinness of the enamel at this point.

Separations of the teeth should be effected by the use of cotton or of wedges of wood; rubber is unfit for this purpose. When the requisite space has been obtained, fill the space with

gutta percha, anchoring into the cavity or cavities, and allow it to remain until the soreness subsides.

Gold fillings should be concealed as far as is practicable, but when necessarilly exposed to view, they should be finished so as to look well. The coarser polishing should be done before the removal of the rubber-dam. The finer finish may be done afterwards, but all the work of finishing should be done with polishing substances. Burnishers should not be used at all. *All* fillings should be contour fillings.

Rapid wedging is admissible in the case of the incisors, but should not be resorted to for obtaining space between the bicuspids or the molars, as this method is not adapted to teeth having more than one root. Undue or too long continued pressure may result in permanent separation, or in inflammation; but if the process is well managed no such effects will be produced.

When the cervical margin of the cavity meets the line of the gum, the cavity should be extended in that direction, until the gum will cover the line of union.

We omit Dr. Webb's views on the treatment of exposed pulps, and pass to his remarks on root-filling.

Dr. W. thinks that the most important thing in filling roots is to secure the complete closure of the apicial foramen. This should be done with gold.

In the treatment of the roots of teeth in which the pulps have previously died, he is careful to carry creosote through the foramen, with a view of causing healing by first intention.

Dr. D. D. Smith, of Philadelphia, followed Dr. Webb with a second report on the same subject.

Dr. Smith advances the proposition that the hardening of dentine is promoted or favored by the use of oxychloride of zinc as a filling material; fills the cavity entirely full at first, and after a time cuts away a portion of the oxychloride and completes the filling with gold. This method is especially applicable to deep-seated cavities.

Dr. J. Foster Flagg, of Philadelphia, read a voluntary essay on "Plastic Fillings, as a Power in Dentistry." It would be impossible to do anything like justice to Dr. Flagg's paper short of a reproduction of its entire contents. We, therefore, hope-

lessly surrendered the task, and our readers must await its publication in the volume of transactions.

Two of the points he made were these:—First, that the new departure consists in this: that gold is *not* the best saving material for the filling of teeth, as has heretofore been universally held. And second, that leakage is positively destructive when the filling is of gold, but not *practically* destructive when the material used is of gutta-percha.

Drs. Friedrichs and Stockton both read papers upon operative dentistry, which we were so unfortunate as not to hear.

A copy of an engraved certificate of membership in the Association was presented by the Corresponding Secretary, Dr. Webb. An animated discussion arose on the question of granting the certificate to honorary members only; but no decision was reached. A seal to be used on the certificate was ordered.

A report on chemistry, prepared by Dr. Noel, of San Francisco, California, was, in the absence of the author, read by Dr. Cushing, of Chicago. The report treated of the destructive character of sugar acids on the teeth, and presented suggestions as to the conclusions to be drawn therefrom. It also discussed and took exceptions to the assertion that sulphuric and nitric acids are generated by the putrifaction of meats and other nitrogenous foods that lodge between the teeth, and in conclusion took the ground that the greater part of dental decay arises from the decomposition of starchy and saccharine substances.

Dr. C. D. Cook, of Brooklyn, N. Y., presented a report on dental literature.

Dr. Taft moved that a committee be appointed to draft an appropriate memorial to the late Dr. George T. Barker, who was the second Vice-President of the Association.

The Chair announced as the committee, Dr. Taft, of Cincinnati, Dr. Cushing, of Chicago, and Dr. Gorgas, of Baltimore.

On motion of Dr. Taft, Prof Buckingham was added to the Memorial Committee.

In Memorium.

The committee appointed to draft resolutions expressive of the sense of the Association on the death of the late Dr. George T. Barker, presented the following, which was adopted:

Whereas, In the wisdom of Divine Providence, our colleague

Professor George T. Barker, Vice-President of this Association, has been removed by death from our midst, in the prime of manhood; therefore,

Resolved, That we feel called to testify, in this manner, our appreciation of his usefulness as a member of our profession.

Resolved, That we deplore his loss and regard his example, both professional and social, as eminently worthy of emulation.

Resolved, That the sympathy of the members of this Association be and hereby is tendered to the bereaved family of our lamented brother.

Resolved, That the above testimonial be inserted in the minutes of the Association and printed on a memorial page in the annual transactions.

J. TAFT,
F. J. S. GORGAS,
GEORGE H. CUSHING,
T. L. BUCKINGHAM,
Committee.

Niagara Falls was fixed on as the place of meeting for 1879.

The officers elected for the ensuing year are as follows:

President—Dr. H. J. McKellops, of St. Louis.

First Vice President—Dr. L. D. Shepard, of Boston.

Second Vice-President—Dr. L. D. Carpenter, of Atlanta Ga.

Corresponding Secretary—Dr. A. O. Rawls, of Lexington, Ky.

Recording Secretary—Dr. George A. Cushing, of Chicago.

Treasurer—Dr. W. H. Goddard, of Louisville, Ky.

Executive Committee, to fill vacancies—Drs. C. N. Peirce, of Philadelphia; G. V. Black, of Jacksonville, Ill.; and G. W. Keely, of Oxford, O.

The President, Dr. Rehwinkle, of Chillicothe, Ohio, in vacating the chair, presented his acknowledgments for the uniform support that had been accorded him by the members of the body, and expressed his best wishes for the future welfare and prosperity of the Association. He then introduced the newly elected President, Dr. H. J. McKellops, of St. Louis, who, upon assuming his position, returned his sincere thanks for the confidence manifested in his ability, by his election to the Presidency. He deemed it a high honor, and appreciating the responsibilities of the position, hoped to be able, with the assistance of those who placed him in the chair, to satisfactorily and properly discharge the duties devolving upon him.

SOUTHERN DENTAL ASSOCIATION.

This Association met at Niagara Falls, Thursday, August 8th, and after transacting its regular order of business, elected the following named officers:

President—Prof. F. J. S. Gorgas, Baltimore, Md.
First Vice-President—Dr. L. D. Carpenter, Atlanta, Ga.
Second Vice-President—Dr. J. R. Walker, New Orleans, La.
Third Vice-President—Dr. John G. Wayt, Richmond, Va.
Corresponding Secretary—Dr. A. C. Ford, Atlanta, Ga.
Recording Secretary—Dr. E. S. Chisholm, Tuscaloosa, Ala.
Treasurer—Dr. H. A. Lawrence, Atlanta Ga.
Executive Committee—Drs. W. C. Woodlow, Augusta, Ga.; G. W. Winkler, Augusta, Ga.; G. W. H. Whitaker, Sandersville, Ga.

RELATIONS OF THE DENTAL PULP TO THE OTHER TOOTH TISSUES.

BY L. C. INGERSOLL, KEOKUK, IOWA.

Any attempt to pass judgment on the relative value of things essential to life or existence is as futile as the decision of the question in the school-boy lyceum, "Which is most essential to the well-being of man—air or water?" To decide the question on its merits, in favor of either side, is to nullify unanswerable arguments on the other side.

If we assume that the relation of the tissues of the teeth is as absolute as the component elements of air or water; if the tooth pulp is, at all ages of the individual and in all its vital conditions, a *sine qua non* of tooth structure, as hydrogen is of water; there is no debatable ground on which to plant a doubt. But, on the other hand, if it can be shown that it is not abso-

lute and unchanging in its relations, but variable with age and its own vital conditions, we may pertinently ask, What are its changed conditions and its changed relations to the other tooth tissues, and how should the facts evolved modify our practice?

Dentists everywhere have encountered the popular opinion that when the nerve or pulp of a tooth dies, the remaining tooth substance is soon lost. How generally this popular opinion has domiciliated itself in the minds of the dental profession is told in the universal interest which the subject of pulp preservation has elicited, during the last twenty-five years It was also made quite evident at the last meeeting of the American Dental Association, when the writer of this paper broached the subject now offered for your consideration. We often find ourselves holding opinions of which we can give little or no account as to how we became possessed of them, except that such is the common belief. A hundred men will walk in the same devious path through the snow, without being able to give any reason for their course farther than that found in the fact that they are following the tracks of the first man that passed along that way after snow-fall. Opinions, notions and tissues of thought are entailed upon us like many of our physical idiosyncrasies. We believe and adopt them because our seniors believed and adopted them. In this era of progress and evolution, a decade of years should not pass without a retrospect of our thoughts and opinions, to determine whether they are founded in fact or in fancy. The learned among the Greeks handed down to their posterity fables as well as facts. In our day we have to deal with ancestral foibles rather than fables.

In undertaking to solve the problem of the functional value of the pulp at different periods in life, and in its varying vital and pathological conditions, I desire first to call your attention to a few accepted facts.

The function of the pulp in developing the tooth is unquestioned. But what does development mean? It means something more than bringing the dental organs into view in the mouth. In this sense an ear of corn with well-expanded kernels is fully developed, while yet the husks are green. But the corn is yet in the milk; and even after the glazing of the kernel with its yellow enamel, there is a hardening process going on

within to bring it to maturity. Teeth when they cut the gum are yet "in the milk." They must gain in density by a ripening process, not so much chemical as functional. When the teeth first appear, the soft tissue bears a much larger proportion to the hard tissue than later in life. There is a period when the developing dental structure in all its form and substance is *wholly* soft, or animal tissue. But from the moment an atom or a molecule of calcifying matter becomes fixed in the periphery of the pulpy mass, this new element is an entity, claiming space. Space previously occupied by soft tissue is relinquished to the hard tissue. Though it is quite possible that by prolification of cells the pulp for a while maintains its undiminished size, the limit of space renders it mathematically certain that at length the soft tissue must diminish in exact proportion as the hard tissue increases.

This supremacy of the hard tissue once gained, every year and every month, lessens the size of the pulp by as much as the hard tissue has gained. *Mark well this tendency to obliteration of the pulp.* It is not a recession or retrogression under pathological influences, but under physiological law. When, therefore, you say that the dentine tubes are being filled up, or that the tube fibrils are being calcified, you are saying this—that the pulp is diminishing its area—that it is diminishing its territorial occupancy—that in the deserted territory the pulp has ceased its functions—that this is the process of pulp extinction. Every progressive step toward calcification of dentine is just so far a measure of the extinction of pulp substance and pulp function.

We all have observed that the pulp in the tooth of a youth is much larger than in the tooth of an adult. In harmony with this is the histological fact that the dentine tubes are much larger in early life than in adult life; also that other fact which has come to the observation of histologists, that odontoblast cells decrease in size and in number with, the age of the tooth.

What is this steady decrease of the size of the dentine tubes, with advancing age, but a steady diminishing of the pulp and pulp influence? What is this increase of the mineral portion, but a decrease of the animal and vital portion? What is this process of calcification of dentine fibrils, this encroachment of

the walls of the pulp chamber upon the pulp itself, but progress towards pulp extinction? What is this process of mineralization of the teeth at the expense of the animal portion but an indication that the economy of nature is being so fully met by mineralization, as to need less and less the functional power and nutrition of the pulp?

We have an example of more complete mineralization and annihilation of function in the enamel. It was once as wholly animal in its tissue, and as dependent upon vital functions, as the dentine. But by a process of more rapid development than takes place in dentine, it passes almost wholly over from the organic kingdom to the mineral kingdom, and becomes in like degree independent of its early organic life. We thus see that the teeth occupy middle ground between the animal and the mineral kingdoms—neither belonging wholly to the one, nor wholly to the other—being in their early organic nature wholly under the control of the animal functions, and in their later and more perfected state subject, in greater part, to the laws of the mineral kingdom. This is an important view of the subject, as shedding some light on the relative importance of the pulp at different periods of development of the dental structures. With the change of substance comes the changed relation of the animal to the mineral portion of the teeth.

The old physiologists numbered the teeth among the bones of the body. But when their peculiar structure came to be studied, it was found that neither physiologically nor pathologically could they be called bones. Comparisons cannot be justly instituted between them and bone, or with any other internal structure. Teeth can more properly be classed with the dermal appendages. They are dermal *out*-growths and not *in*-growths, and, like all out-growths, arrive at a measure of independence of that vitality so essential to all internal structures.

In the animal kingdom teeth are allied to horns, scales of fishes, the hard covering of some insects, and to all crustacea; and in their relations to vitality should be compared with these rather than with bones invested with flesh.

For a single illustration take the horn of a deer. The deer's horn has both an inner and an outer pulp. What is known as the "velvet" is the outer pulp. This is highly vascular and

wonderfully active in its formative function. Its vessels communicate with the inner pulp through the hardening tissue of the horn as the nerve fibrils of teeth ramify the dentine. As the soft horn becomes mineralized, the canals, through which the outer and inner pulps communicate, are gradually filled up, till at length the outer pulp is cut off from its connection with the inner pulp, and dies. Then by the dictate of some animal instinct its bloody substance is rubbed off. Thus the outer portion of the horn is left without vital support and nutrition.

Tomes, in his Dental Anatomy, speaks of classes of teeth "in which the whole pulp is converted into solid material and no pulp cavity remains." [p. 79.] Then on the following page says: "The pulp of a sperm whale *becomes obliterated* by a development of secondary dentine." In speaking of the tusk of the elpephant, which is probably as nearly identical with human dentine as any animal formation, he says [p. 323]: "The last remains of the pulp are converted into dentine in which a few vascular canals persist; these, of course, occupy the centre of the tusk, and are small in amount."

Of the teeth of rodentia, he says [p. 337]: "The last remains of the pulps are converted in secondary or osteo-dentine, which thus forms the central axis of the incisors or molars, as the case may be. In this tissue vascular tracts sometimes exist, but altogether small in amount; the formation of true dentine going on till the pulp at that particular point is almost obliterated." On page 339 he says of the same: "Near to the surface actually in wear, they [*i.e.*, the dentinal tubes] become cut off from the pulp cavity, by the conversion of what remains of the pulp into a laminated granular mass, so that the dentine exposed on the surface of a rodent's tooth must be devoid of sensitiveness, and the contents of the dentinal tubes must have presumably undergone some change; but what the nature of the change in the contents of the dentinal tubes which have ceased to be in continuity with a vascular living pulp may be, there are, so far as I know, no observations to indicate."

In his description of the teeth of the parrot-fish we read [p. 213]: "When calcification has proceeded so far as to obliterate their central pulp, cavities, etc."

The above facts lead us to the conclusion that the develop-

mental process in the formation of the dentine is continuous and toward perfectibility, and that perfectibility of dentine means a calcification of dentinal fibrils, so complete as to wholly exclude vitality from the area so calcified. Notice, too, this completeness of calcification, is not the result of formative action excited at indefinite intervals by irritation from without, or by any external influence; but it is *inherent in the nature of the function*, and is a continual progression according to physiological law.

In the mouths of some persons this perfectibility of structure is greatly retarded or wholly prevented by diseased conditions, general or local. Operations on such teeth are always attended with pain, even after middle life of the patient. But the experience, even of a limited practice, brings convincing evidence of teeth in the mouths of persons of healthful organization that are entirely free from sensation throughout a large portion of their crowns, rendered so by a completed calcification. Such teeth are found in the mouths of many persons in middle life and on down to old age. We should be familiar with a larger number of cases of this kind, except that persons with such teeth seldom need the services of a dentist. By every test for vitality, such dentine, receiving no nutrient support from the pulp, is really dead. Yet every dentist reckons such teeth in the soundest possible condition—least disposed to decay. For this is the most complete tooth structure—complete in proportion to the obliteration of the pulp fibrils, thereby rendering such portion of the hard tissue independent of pulp influence.

Let us now examine the dental foramen to see if it does not teach us a lesson pointing to the same fact which I have been attempting to establish. We find that in childhood and in youth, during the period of most rapid development of tooth structure, the dental foramen is wide open, permitting the passage of many vascular canals, freighted with tooth material, for the building-up process. But with the progress of the work this gateway gradually closes. The dental foramen becomes smaller and smaller, till at length we find it scarcely perceptible to the unaided eye. Here there is a reduction of the capacity for nutrition in proportion to the demand of the structure for nutrient support, and further evidence of the diminishing importance of the pulp.

I propose now to consider some objections to the view here presented.

The objection which most readily finds utterance is that to which I have alluded as a popular impression, and accepted, too, by many of the profession, viz: that the pulp is an absolute and essential factor, not only in the construction of the tooth, but in its preservation—that it holds its elements from dissolution. When popularly stated it is this: "When the nerve dies the tooth will rapidly decay." When stated by the profession it is this: "When the circulation of nutrient material has been cut off by destruction of the pulp, the dentine will surely tend to disintegration."

In answering the objection in the first form stated, I need only allude to the numerous cases of pulpless teeth standing in the mouth in all their integrity—save the decay that wasted them while the pulp was alive—and such teeth have stood for many years. A little inquiry will bring to our notice, almost daily, in the mouths of our patients, teeth still firm that have been pulpless for ten, twenty or thirty years.

Should the pulp be devitalized in early life, all dentists would regard the chances of preservation of the remaining structure less favorable than when the devitalization occurs late in life, because of the greater porosity of the hard structure in early life. Yet the instances are numerous of boys and girls having teeth knocked loose by a blow or a fall, which perfectly destroyed the vitality of the pulps, and such teeth have been preserved, though greatly discolored, till advanced manhood or womanhood. Not long since I discovered two dark pulpless teeth in the mouth of one of my patients fifty-five years of age. On inquiry I learned that the accident occurred at fourteen years of age by the kick of a colt. These teeth were firm and free from decay. It needs but little inquiry to learn of cases sufficiently numerous to satisfy the popular mind on this point.

But to answer the objection to the second form stated, coming from the professional standpoint. I am aware of the preconceived notions and theories which persistently assert themselves; gaining strength by repetition. An objection, representing the views of a large number of the profession on an important point in theory and practice is worthy of a candid consideration.

The objection is based upon the nutrient function of the pulp. It is a commonly received opinion that there is a perpetual change of tissue throughout the entire organism—that it requires but a few years at most to effect so complete a change that not one atom of old tissue remains. This is an old doctrine. It antedates dentistry and dental science. Its proofs were given to the world before the peculiar structure and organization of the teeth were known, or even before it was well understood that they had anything peculiar in their organization and structure—anything to distinguish them from bones. Has modern investigation ever given any proofs that the teeth are subject to the law of waste and supply in common with other tissues of the body? We know that the organizing functions, treat the teeth in a very different manner from bones to which they are nearest allied. Bones may be wasted by disease, portions removed by fracture, or cut away by a surgical operation, and the lost parts will be restored by the organizing functions. Not so the teeth. When wasted by disease, abrasion, erosion, or a dental operation, no part of the lost tissue of a tooth is ever replaced. Dentists sometimes talk about nutrition of enamel. Why, then, is the enamel organ counted out, after the emergence of the teeth from the gum, and no longer numbered among tooth tissues? Where is the possibility of organic function being carried on with but one per cent. or three per cent. of animal tissue, while the ninety-seven or ninety-nine per cent. is of such crystalline density as to exhibit no more vascular trace than quartz? True, sensation has sometimes been discovered in the enamel, and an occasional dentine fibril has turned up a loop into the enamel But what can such exceptional cases prove more than the possibilities of abnormal structure?

Nutrition implies consumption and waste of tissue through the activity of animal functions. Where there is no waste of material there is no necessity for replacement. A structure that is composed chiefly of perishable material, like the soft tissues of the body, must of necessity require perpetual supply of new material, which we call nutrition, else the whole structure is soon broken down. In proportion as the structure is built up of *imperishable* material—not absolutely such, but imperishable as it

stands related to existence of the individual—in like proportion is the necessity for replacement by nutrition diminished.

The teeth are composed so largely of imperishable material, that it is not in accordance with the philosophy of organic life to presume, in the absence of incontestible proofs, that the hard and imperishable material would be replaced simply because the soft and perishable animal tissue is continually undergoing replacement. This would be a waste of vitality and function, of which nature is never guilty. All observed facts point to the teeth as a peculiar structure, not subject, like other tissue, to the law of waste and supply, requiring the nutritive functions of the pulp only to preserve intact their perishable animal tissue.

Again, if the matured tooth in its undiminished whole, needs the nutritive function and vital support of the pulp to preserve it from disintegration, every portion of the tooth needs it alike. Nature pursues a damaging course and greatly blunders when she calcifies the dentine fibrils, and thus cuts off sensation and vascular action from any portion of the dentine, if such connection with the pulp is *necessary* to preserve the integrity of the dentine. All dental observation is a defense of nature—for we find the most thoroughly calcified teeth to resist decay the longest. These hard, dense teeth, that can be drilled into and excavated without pain, are the most enduring structures known to us; while the teeth that have large pulps and large dentine fibrils, fully active for nutrition, but not for calcification, are teeth readily disintegrated, and which give no promise of long continuance.

Let us look still farther at portions of the dentine cut off from pulp nutrition by decay, instead of by the physiological process of calcification. In every tooth penetrated by extensive decay, many of the dentine tubes are cut off, and, of course, the outlying dentine is cut off from all direct communication with the pulp. But this does not necessarily cut off all pulp nutrition; for the plexus formed near the border line of the dentine and enamel by the anastomosis of the dentine tubes and the looping of pulp fibrils is adequate to sustain vitality, for a while, in every part of the peripheral portion of dentine. But in numerous cases of extensive decay we find some portions of the walls of the cavity void of sensation, by reason of the death of the pulp fibrils.

And we are all familiar with the fact, too, that when found very sensitive, if such cavities are filled and reopened after six months or a year, we often find the fibrils dead, although the body of the pulp be yet in a condition of activity and life; or the same non-sensitive condition of the walls of the cavity may have been brought about by calcification of the plexus. In either case, pulp nutrition is cut off from a portion of the dentine. And we are familiar with the further fact, that if such cavities are thoroughly filled, the whole tooth—including the devitalized portion—is preserved. Thousands upon thousands of such cases witness to the truth to this statement.

The conclusion is, that if part of a tooth in such condition may be preserved from disintegration, the whole tooth may, under favorable conditions, be preserved indefinitely from disintegration, though freed from pulp nutrition by the death of the pulp.

Another objection, or another form of the same objection, is found in the statement often made, that vitality protects the teeth from decay. Why, then, are the teeth not protected from decay? as they all have pulps. It is popularly said, too, that it is the special purpose of the enamel to preserve the teeth from decay. Why, then, with both these safeguards, are not the teeth protected from disintegration by caries? I take it that the teeth are enameled to protect them from abrasion—that they are enameled for the same reason that instruments made of iron are pointed with hardened steel, or case-hardened—to protect them from waste of substance by use, or to give them a cutting edge. Protection from decay is only an incidental and concomitant fact.

Protection from decay by vital action in the calcification of the dentine fibrils, is in perfect harmony with the views here presented. But *arrest* of decay through vital action is of rare occurrence. Some have seemed to convey the idea in their remarks on this subject, that the *mere presence* of vitality inherent in a living pulp had some mysterious power to prevent the action of those agencies which produce decay. Facts are strongly against this notion. I need in this connection but to again refer to the rapid decay of youths' teeth from the age of fourteen to twenty, when they are in the condition of the most active vitality. Another significant fact bearing on this point is, that recent decay is

seldom found in the non-vital portions of the teeth of old people; but you look for fresh decay about the necks of the teeth where vitality is still active in dentine.

In suggesting any modification of practice based upon the positions which I have taken on the relations of the dental pulp to the other tooth tissues, I am aware that the conservatism of the world is such that mankind are struck with alarm when any note is sounded not in harmony with cherished theories and adopted practices. For a number of years past we have been lulled to rest, concerning exposed pulps, by the narcotism of creasote and oxychloride of zinc.

The profession have been led to believe that the destruction of the pulp is well nigh equivalent to the destruction of the tooth; that therefore the slightest evidence of lingering vitality however feeble, is a sufficient warrant for persistent treatment ending with the oxychloride capping; and that such means are specific in restoring the healthful condition and functional activity of the pulp. Hope is a good thing—a most excellent quality of mind, and *trust* for a realization of the thing hoped for is a counterpart of the same. But hope and trust must have a basis of facts sufficiently broad and deep, else hope and trust are not reasonable.

I ventured the opinion, at the last meting of the American Dental Association, that we had hoped in many cases without good foundation and trusted too implicitly in the treatment, and believed too confidently in results. I hold these opinions still. I would not have the profession abate one whit the desire, to preserve exposed and diseased tooth pulps, nor the study and experiment requisite to that end. But I would have them diagnose more thoroughly their cases, observe more critically their successes, and modify their practice by a more careful judgment of physiological and pathological facts.

Dentists must acknowledge that the diagnosis of a diseased pulp is extremely difficult; not so much as to its present condition as to its vital power and susceptibility to treatment. If we bear in mind the facts as set forth in this paper, I think we shall conclude that the pulp has not a *tenacity of life,* except under the most favorable conditions. Its gradually diminishing substance and gradually diminishing functions, and its tendencies toward

obliteration, should be considered ; and should enter into a diagnostic opinion as to the results of treatment.

I believe that a judgment based upon sensation, or the impression of pain, has led many a hopeful and anxious dentist astray. It is not a very uncommon occurrence to find teeth that have wasted away—the entire crown, including the pulp—without causing any serious pain or discomfort. The treatment of teeth having this tendency might greatly deceive an operator who trusted chiefly to sensation in making a diagnosis. This quiet condition of an exposed pulp is a fearfully morbid condition. To cap and fill over such a pulp because it is quiet enough to tolerate the presence of foreign material, as it has tolerated contact of the atmosphere and fluids of the mouth, will not arrest the tendency to devitalization. "Failure" may be written on the record in less than six months.

I would not even attempt treatment of pulps in this class of teeth.

Again, dentists are no doubt often deceived by the quieting influence of anodynes and narcotics. A patient comes into the office having a tooth that has often been the cause of severe pain. The dentist applies the remedy and almost instantly the pain ceases ; and so long as it is narcotized it gives the patient rest. To assume, therefore, that this freedom from pain is evidence of health and restored function is a false assumption. It is no more evidence after five or ten days than the first day.

While penning this part of my paper, two cases were presented at my office by a lady from a neighboring city. For three weeks she had been annoyed, and at times greatly distressed, with pain on the right side of her face. She identified the second superior bicuspid as the source of it. On examination I found her teeth well cared for, both personally and dentally. The teeth in that locality had been filled in a most skillful manner, so far as I could judge from external appearance.

The offending bicuspid had in it a large gold filling, inserted about a year and a half previous, also another in the first molar. I instituted inquiry to learn the facts and circumstances attending the operation. I learned that both teeth had been treated for supposed exposure or sensitiveness of the pulp, and capped with oxychloride of zinc. My diagnosis of the case was that in the

bicuspid the pulp was in a high state of inflammation, involving the peridental membrane—that in the molar the pulp was wholly devitalized, decomposing, and abcess imminent on the palatine root. I drilled into the crowns of both teeth, found the capping as represented, and the pulps according to diagnosis, except that the pulp in the molar had not become as thoroughly disorganized as I anticipated.

No doubt these teeth stood on the record of a good operator marked "success." All painful sensation was allayed during his treatment and filling, and for six months after. Suppose that the operator in these cases had considered the tendency of the pulp to obliteration, and the slight tenacity with which it holds its vitality when diseased, or disturbed even by slight causes; he might have judged it better to extirpate the pulps of these teeth at *first*, than to run the risk he did; though with his confidence in the popular treatment he *might not* have considered it *any* risk.

Yet every dentist should consider the risk, in view of the large number of failures in the treatment. He should consider the many teeth in which the pulps have died when decay had penetrated the dentine but slightly, and the operator had never thought of any risk in filling.

How many of us have been surprised on examining such cases in one or two years after filling, to find the pulps dead or dying? He should consider the number of cases in which the death of the fibrils has caused disease or death of the pulp.

He should consider the physical idiosyncrasies of the patient, the history of other cases, if any, in the same mouth; and the complete or incomplete organization of the teeth.

Considering the points above enumerated, we may well conclude that of the cases needing treatment of any kind, as a means of preserving the pulp alive, only the most favorable presented, offer hope of *permanent* success—that a chronically congested pulp, a suppurating pulp, a tumefied pulp, a half-destroyed pulp, each and all are extremely doubtful of results—so doubtful that the chances of permanent preservation of such teeth are better by means of extirpation of the pulps than by any treatment at present adopted for their preservation.

The large number of cases of spontaneous death of the pulp *after treatment*, and the damaging effect of such death on the root membrane, should be a serious warning to every operator.

In the mouth of an adult individual, a healthy, vigorous root membrane is of far more importance than an emasculated pulp. To endanger the normal condition of this membrane is a more sure endangering of the tooth than anything that can possibly happen to the pulp which does not necessarily involve the root membrane. How many teeth with healthy, vigorous pulps, are annualy lost by a wasting away of the root membrane and alveolar processes! And dentists as yet are able to offer but temporary check, except in few cases, to the progress of the disease. I would say, then, in all cases avoid a slow spontaneous death of the pulp, if you would avoid a chronic disease of the root membrane.

It may be replied to this that extirpation of the pulp endangers in like manner the root membrane. I am aware of the delicate nature of the operation of extirpation. It is an easy matter to devitalize a pulp, but to extirpate it, is another and wholly different operation. If an operator allows himself simply to devitalize, and not remove wholly the debris from the root canals, he may surely expect trouble in the root membrane. Delicate and difficult as this operation is, in the flattened roots, time and patience in the use of the requisite means will accomplish it, and leave the peridental membrane unharmed. This being the case, we may expect a long continuance of a pulpless tooth in the mouth.

Here we are confronted with the objection that, after the death of the pulp, the root membrane being compelled to perform vicariously the function of the pulp, induces hyperæmia, and at length its own destruction. This objection is a *petitio principii*. It assumes, without proof, the main point at issue. In premise and conclusion, it is false to fact. Vicarious performance of function is in this case anatomically impossible; and as I have shown, I think, in this essay, it is not physiogically required.

If the peridentium is left unharmed by the death of the pulp the performance of its own legitimate functions is alone adequate to sustain the tooth structure in all its oral relations. The hard

tissue having gained a sufficient degree of density and hardness to maintain that structure by a law of mineralization independent of the vital functions of the pulp, will certainly on the death of the pulp, make no unusual demand on the peridentium for vital support. It no doubt gives its measure of support to dentine of the roots, and also to the dentine of the whole tooth, so long as the nerve plexus remains intact throughout the whole structure. Performing thus *its now* legitmate functions, it is enough.

In concluding this essay it seems necessary to guard against misapprehension, thoughtless antagonism of ideas, and unwarrantable conclusions; for some gentleman may rise and say, "If the teachings of this paper be correct, I see no need of the dental pulp; we may as well extirpate the pulps of all the teeth at once, and save mankind from all contingencies of dentalgia and loss of teeth." A foolish objection, indeed! I will, however accept its rational aspect so far as to say that the contingencies alluded to are neither sequences nor consequences of *healthy* pulps in *sound teeth*. For a similar reason ignorant operators have removed sound and healthy teeth of the first set to encourage the development of the second set. Leave nature to eradicate temporary teeth, and to obliterate pulps in her own time and in her own way. The practical bearing of this paper regards only the treatment of *diseased and dying pulps*.

Another may say, "If teeth arrive at maturity in density and hardness in any specified number of years, then it may be said that the pulp is of no further use. In that case I see no reason why we should not abandon pulp treatment altogether, and extirpate every exposed pulp."

This objection rests on a misapprehension and a misstatement of the teaching of this paper. The conclusion drawn from the decreasing size, decreasing functional power and decreasing resources of the pulp, was that the tooth structure arrives at a period of development fully adequate to every performance of function before middle life; and that therefore the pulp is of little importance in the economy of nature, compared with its importance in earlier life. I do not say of *no* importance. In any case of exposure, with little or no disease of the pulp, it is worth while to attempt to save *this little* of pulp function whenever it

can be done with a reasonable degree of certainty. But that there is a period when the hard structure has arrived at such a degree of maturity, that, in case of disease, the *comparative value* of the pulp is to be considered, will be readily conceded; and with chances of final restoration to healthy function are also to be well considered the natural tendencies to obliteration, and the consequent feeble hold the pulp has on life. The question of *abandoning* treatment, pertains *only* to the class of badly diseased pulps.

Another will say, "I prefer to give the treatment, *in every case*, and take the chances; if death of pulp and abscess follow, let it come. I will then cure the abscess." In the prognosis of a diseased and dying pulp, something else is more worthy to be considered than simple abscess. Abscess induced by a slow ebbing out of the life, and slow wasting of the substance of the pulp, is not of the benign character of an eight-days' abscess, although the latter may inflame and swell with ten-fold more pain and discomfort to the patient than the former. It is the chronically congested condition of the root membrane that attends a slowly-forming abscess, and that so often remains without cure, after the abscess itself is cured, that should excite the alarm of every operator who will willingly run the risk of abscess in the confidence he has in an easy cure.

The preservation of the teeth in their entirety is conservative dentistry. But when, by inevitable disease, the vitality or functions of two or more kinds of tissues are endangered, it is the part of wisdom to sacrifice that which is of least importance.

The whole thought of this paper has a basis in the comparative value of the pulp at different periods in life, which I have attempted to establish as a physiological fact. Its tendency to gradual obliteration, and its ready death from very slight causes —as from the presence of a small filling in a cavity, that has penetrated not more than half through the dentine—have been brought to your notice to show with what feeble tenacity the pulp holds its vitality, and to show its very limited susceptibility to treatment when diseased. Any modification of practice which may grow out of the view of the subject here presented should be based more upon the greater probabilities of the continuance of teeth in the mouth till old age, by the careful and

skillful extirpation of an emasculated pulp, than upon any treatment popularly resorted to for its preservation.

DISCUSSION.

DR. SAFFORD G. PERRY (*New York*):—It appears to me that practice founded upon the conclusions of Dr. Ingersoll's paper will generally be sound. For years back I have not undertaken to assume that so long as a pulp gave no trouble all was well. In all cases in which I have capped pulps, the operation has been only a tentative one. In no case, for a number of years, have I permanently at once filled a tooth, the pulp of which was actually exposed. I have practiced filling such teeth with amalgam after capping, which might be easily removed should the pulp die; and have instructed the patient to immediately report the first symptom of pulp trouble, in order to avoid risk of injury to the root membrane. It seems to me this membrane should be especially well guarded, for the usefulness of the tooth depends more upon its integrity and well being than upon anything else.

Another point seems to me of much consequence—the age at which teeth may safely be devitalized. In teeth in which consolidation has fully taken place, devitalization will do less harm than if the tooth is not consolidated, while with unconsolidated teeth—young teeth—the paliative, conservative treatment should be adopted. I have not yet reached the point of capping after a portion of the pulp tissue has been devitalized. I know it can be done successfully, for I have seen several cases; as, a live pulp in one root, and abscesses on the other roots. Cases of such persistent pulp vitality are not uncommon; and perhaps it may prove that we can preserve life in almost any condition of the pulp except where death has already occurred. But is it necessary to do so? We know that a safe and serviceable tooth may be obtained by devitalization and proper root filling. I don't like to take risks with my patients. With a capped pulp it seems to me there is always danger; while all the gray-haired men present will support me in saying that a devitalized tooth, well filled, is as safe as any tooth can be made. I am happy to be able to say that, especially in the last few years, such a thing as having a capped pulp coming back to me with an abscess is al-

most unknown. Perhaps because I cap only favorable cases. The procedure can be made almost as certain as any in the range of our operations. If a tooth has been capped, and, after a year or two, deposition of secondary dentine has occurred, that tooth may then be filled permanently, with almost a certainty of permanent success. Two years ago I treated an upper molar, in which there was small exposure. I made a careful record of the circumstances at the time, and then introduced, first creosote and oxide of zinc, and then oxychloride, finishing with gutta-percha. Recently I removed this filling because the gutta-percha had worn away, and allowed food to remain lodged near the gum; and also to ascertain the condition of the pulp. I found everything exactly as it was when the operation was performed. There was the same extent and character of exposure, in the same place. I again filled the cavity, proceeding exactly as before, except that I substituted amalgam for gutta-percha, in order to restore the contour of the tooth. This operation I completed at one sitting. I do not regard the amalgam in this case as a permanent filling. I shall test the tooth with ice every year, and if I perceive a loss of vitality I will remove the amalgam. I hope, however, to be enabled, some day, to put in a gold filling in that tooth, over a live and healthy pulp.

DR. E. A. BOUGE:—Last week I removed a temporary gutta-percha filling, under which was an oxychloride cap, the whole having been put in by me about two years ago. The condition of the pulp was much as Dr. Perry describes, there being the same extent and manner of exposure as when the cap was put on. I have long been of the opinion that when the odontoblasts of the peripheral portion of the pulp are destroyed, through amputation or ulceration, a deposit of secondary dentine does not occur. This is, to me, practically the same as saying that when the exposure is large, or of long duration, I have little faith in the probability of the restoration of that pulp to a healthy condition under a cap. I do not say that such a thing cannot be done; but, to me, the risk to the tooth in such cases is greater than if the pulp is destroyed and removed. I believe that the function of the pulp in adult life is, mainly, deposition of secondary dentine behind the orifice of decay, after the manner best described by Hume. In such part of Dr. Ingersoll's paper as I

heard, he does not refer to this point. His theory is both proved and disproved by the instances he adduces in its support For example, he speaks of hard, dense teeth, in which the fibrils have nearly disappeared, as being less liable to decay than loose-structured teeth in which fibrils are plenty and sensibility exalted. I do not suppose that either the presence or absence of the pulp has much to do with decay of these teeth. On the other hand I think that in all surgical analogy in careful amputation of any non-vital organ, the parts are much more liable to heal and remain sound when anything extraneous to them is not left behind to become decomposed. I wish to be able to supply such conditions to the tooth as will most surely result in its restoration to health and usefulness; and I believe that, in many cases, the shortest and best method, for both the patient and operator, is devitalization and entire removal of the pulp.

Dr. J. Morgan Howe (*New York*):—In a paper which I read before this Society somewhat more than a year ago, I expressed the opinion that when any considerable portion of the peripheral odontoblast cells of the pulp have been removed, there is little possibility of any deposition of secondary dentine in that quarter. I am glad to hear my conclusions endorsed to-night. I think there are many things in the paper we have just heard which should lead us to take a broad view of this subject. We all recognize the value of a live pulp in a healthy tooth; but it seems to me that consideration for the pulps, should not lead us to neglect consideration for the patient. To save pulps is very good; but it is better, I think, to save teeth, with the least possible pain and trouble to the patient. We should not drift into a stereotyped practice, but should treat each case according to its own attendant circumstances. About two years ago a young girl, sixteen years of age, came to me with an exposed pulp in an upper cuspid. Although the pain was severe, I was greatly disinclined to destroy the pulp. I endeavored to stop the inflammation, but with little success. For three days the patient begged me to destroy the pulp, but I refused; and finally the pain ceased. I covered the exposure with oxide of zinc and creasote, followed by a little oxychloride, finishing the cavity with gutta-percha. About six months ago I removed the filling and examined the cavity. The dentine was sensitive, and I was satisfied that I had

saved the tooth. About two weeks ago I again examined the tooth, and found it healthy and of notmal color. The course pursued was successful with that tooth and patient; but I do not think I should have been justified in acting the same way with a tooth farther back in the mouth, or with an older patient.

DR. A. C. HAWES (*New York*):—I believe that the majority of exposed pulps, if treated to save them, die within two years, in spite of treatment. The pulp gets, as it were, a deadly blow by exposure, which will eventually cause its death. I lately remarked what I believed to be true, that there will surely be a reaction in this matter of wholesale attempts to keep exposed pulps alive. I do not quite understand whether Dr. Perry approves of the destruction of exposed pulps.

DR. PERRY:—I have felt for some time past that Dr. Howe was right in his conclusions as to the impossibility of closing the breach over an exposed pulp when the odontoblasts have been destroyed. Therefore, with an elderly patient I should probably destroy and thoroughly extirpate a largely exposed and badly inflamed pulp. I should then feel, after the root was well filled, that I had pursued the course best calculated to retain that tooth for future usefulness. I do not like to relinquish such a reasonable certainty for the chances of failure sure to be incurred by attempting to save such a pulp. However, with a young patient I should expect many more chances of success through capping than with an older one.

DR. BENJ. LORD:—Will Dr. Howe detail his method of treatment in the case he has just narrated?

DR. HOWE:—Tincture of aconite root and creosote, half and half, and an application of iodine. I hardly think the iodine had much effect.

DR. C. D. COOK (*Brooklyn*):—What creosote?

DR. HOWE:—Pure wood creosote. I have had some creosote since then, about the value of which I have doubts, since it does not readily attack living tissue. I prefer wood creosote to carbolic acid.

DR. COOK:—As I understand it, wood creosote does not produce an eschar on living tissue.

DR. HOWE:—I did not expect an eschar, but looked to see the soft tissue whitened when touched by the creosote. As to Dr.

Hawes' implied criticism of my course, I feel that it is just, and that I should not, under ordinary circumstances, have been justified in doing as I did. But the end was my justification. I would strive very hard for the life of the pulp in a front tooth of a young patient; but under other circumstances I would be apt to quickly apply arsenic.

Dr. Bougue :—I have in mind three instances in my own practice, occurring very lately, where deposits of secondary dentine had so engorged the chamber, that I had the greatest difficulty in entering the pulp canal. The chance of such deposit apppears to me to form the most prominent reason for preserving pulps.

Dr. Cook :—In Dr. Hawes' remarks I noticed more matter of "belief" than statement of fact. Now we have all found our "beliefs" to come to nought, especially as to the treatment of of dental pulps. Six months ago my faith was similar to that of Dr. Hawes. I did not believe so many pulps were saved as reported. I had followed the Atkinsonian method from its first promulgation. About six months ago, having heard that oxide of zinc and creosote, covered with oxychloride, would be of benefit for exposed pulps, I took that "new departure," and, to me, it has proved of value. In a number of cases, where the person has not been suffering from pain, I have not hesitated to fill the tooth after such treatment, and have not had one such case return to me with pain as yet.

Dr. Perry :—Have you done this in cases of large exposure?

Dr. Cook :—I have not made a record, and speak from recollection alone. Still, I know my patients have not returned to me. They may have gone elsewhere. I do not know as to that. I think we sometimes lose sight of that point in our statements of cases. Some one else may have been the executioner of those pulps. Belief in the matter of research, is of little value. Facts are what are needed. A careful record of all observations in this direction would be of immense value to us. I do not say that the method I am pursuing is the only worthy method. A system of records would doubtless introduce to us other ways of perhaps even greater value.

Dr. Hawes :—My belief in this matter is founded on long experience and careful observation. I know that pulps die, upon which I have expended my best efforts, and used to the full the

most approved modern saving doctrines. I have the least trouble in cases in which I destroy the pulp promptly—under the proper conditions, of course.

DR. COOK :—At what age does Dr. Perry call a person "elderly"?

DR. PERRY :– I know no exact rule, but I suppose forty is older than ten. I should treat a person of forty differently from one of ten. I know no better way of arriving at an answer to that question than by keeping a careful record of all cases, and, from time to time, comparing results with circumstances.

DR. COOK :—In case of fracture of any bone in a healthy person, would you expect to cure as readily at forty years of age as at eighteen?

DR. PERRY :—The reason why I should be more ready to devitalize at forty than at ten is, that at forty I have a solid, completely calcified tooth on which to work; while the porosity of the child's tooth would much decrease the chances of success.

DR. W. T. LAROCHE, (*New York*) :—I have been able to save more teeth by capping, using creosote, gutta-percha and tin, than by any other way. I am careful not to touch the pulp if I can prevent it. I put in creosote and oil of cloves, allowing the application to remain about a minute, and then dry very carefully with a small piece of paper. I then take a small piece of very soft gutta percha, and with a properly shaped instrument stick it to one side of the cavity and draw it across, over the exposure, to the other side, thus forming a cap. This can not be done with White's or Johnston's gutta-percha. I then cool it with an air syringe, and lay a piece of tin foil over it, finishing with gold. Of course the gold is very close to the pulp, but it does not touch it. I have a number of cases so treated, now three or four years old, and in which I have actually seen the pulps, which are doing well. Of course I can not tell how long they will remain so; but the operation is, so far at least, successful.—*Transactions of N. Y. Odont. Society in D. & O. Science Magazine.*

THYMOL.

As an antiseptic, thymol or thymic acid, has probably not received the attention that its merits would seem to deserve. Its virtues have been for some time known to dentists and physicians, but it has not attracted the notice of practitioners in any considerable degree.

The London *Chemist and Druggist* presents the following summary of its claims: It is prepared from the oil of garden thyme (*t. vulgaris*), also from the oil of wild thyme (*t. serpyllus*). The oil of the former is most pungent; that from the latter more pleasantly flavored, as well as milder.

Several German surgeons, says our cotemporary, in 1873 published investigations of its antiseptic properties, which are estimated to be from four to twenty-five times as powerful, under certain circumstances, as those of carbolic acid. Thymol is a crystalline, nearly colorless body, with a pleasant odor and an aromatic burning taste. Its specific gravity is 1.028, and it melts at 44°C. It dissolves in 1,200 parts of cold water, 1 part of rectified spirit, 120 parts glycerine, and in one-third part of caustic alkalies. Fats and oils dissolve it readily. It is prepared from the oils of either of the plants before mentioned, but pharmaceutists should beware of experimenting on English samples of oil of thyme, as but few of them are genuine, or, at least, contain any thymol. The oil is said to yield as much as 50 per cent. of thymol on the continent. Thymol can be manufactured from these oils by treating them with an equal volume of a 20 per cent. solution of caustic soda, separating the alkaline liquid and neutralizing with hydrochloric acid; when the thymol will float to the surface. It may also be obtained by submitting the oils to a low temperature for a few days, when the thymol crystalizes out. Its powerful antiseptic action, exceeding under some conditions that of carbolic acid; its small activity as a poison, about one-tenth that of carbolic acid, and the absence of irritating effect when it is applied to the skin, all point to its use as a substitute for carbolic acid in the well-known anti-septic treatment of sur-

gical cases elaborated by Professor Lister. This substitution has been made with great success by Professor Volkmann, of Halle. For the spray solution this gentleman uses a mixture of one part thymol, 10 alcohol, 20 glycerine, 1,000 water; but we understand that a solution in water only, which will not deposit, may be made by adding 1 part of thymol to 1,000 of hot water. For the gauze dressing used by Professor Lister others were substituted, made by saturating 1,000 parts of bleached gauze with a mixture of 500 parts spermaceti, 50 resin and 16 of thymol. This prepared gauze is extremely soft and pliant, and, to use the words of the reporter, sucks up blood and the secretions of the wound like a sponge. The fibers of the gauze being impregnated with spermaceti, cannot, of course, become saturated with the secretions, so that they do not become stiff. Thymol has been used for various diseases by Dr. R. Crocker, but the results of his experiments have not been published. As an internal remedy, thymol does not seem to make much way. It has proved useful in diseases of the stomach accompanied by fermentation, and Mr. W. H. Stone reports in the *Medical Times and Gazette* that he has found it useful in cases of chorea, one form of which is St. Vitus' Dance. The present cost of thymol is about five times that of the best carbolic acid, but as one part of the former seems to do as much work as 25 parts of the latter, the advantage of price is on the side of thymol.

The lotion may be prepared as follows:

Thymol..... 1 part.
Alcohol (85 deg.)..... 4 parts.

Dissolve, and add distilled water 995 parts. Used for injections, washes, etc.

THYMOLIZED VACCINE LYMPH.

In a former communication to the *Zeitschrift f. Pract. Medizin*, (May 25th, 1878), Prof. Köhler, director of the Provincial Vaccine Institute of Halle, speaks as follows concerning "*thymolized vaccine lymph*:"

Dr. Küssner, assistant in the Medical Clinic, has been for a long time engaged in my laboratory in observations on the effect of thymol on the circulation, respiration, and nervous functions. The publication of the results of this work, interesting in many points, I will not anticipate, but only report the practical realization of one of these results, which seems to me to deserve more than ordinary consideration at the present time, when so much is being said and written for and against human vaccine lymph.

This communication relates to the "thymolization" of vaccine lymph fresh from the arms of children, which has been done since the beginning of the present vaccinating period, in the institution conducted by me, after a series of experiments, which Dr. Küssner, will describe in his exhaustive treatise, had proven with absolute certainty, (1), that the thymol solution (1 of thymol to 1,000 of water) added to fresh lymph in equal quantities will prevent any decomposition of the latter from the entrance of air, moisture, and elevation of temperature of the atmosphere, and (2), the thymol, notwithstanding this antiseptic power when introduced with the lymph does not prevent normal and favorable development of pocks in exactly the same time as when good unmixed human lymph is used; so that I open the vaccine pustule in the well known way, receive the lymph in suitable capillary tubes, immediately blow it out into watch glasses, and then add the contents of exactly the same number of capillary tubes filled with the thymol solution, as there were tubes filled with lymph. Thus I obtained a "thymol-lymph," which has thus far never failed in a single case, notwithstanding (as in "glycerine lymph") the volume has been doubled by thinning with equal weights of the thymol solution. Vaccina-

tion with this thymol lymph is not painful, as with ordinary humanized glycerine lymph, and phlegmonous symptoms have not resulted therefrom in a single instance; on the contrary, the pocks heretofore observed, for perfection of development and regularity of course leave nothing to be desired. Furthermore, as we are fully convinced of the disenfecting effect which thymol exercises in its weak solution on vaccine and other animal fluids, so may we be assured by many observations, that the development of the vaccine pustules is in no way hindered by the thymol lymph. It is especially recommended during the present hot season, to preserve and dispense only such humanized lymph mixed in the above named proportion with thymol. This preserved in small, well corked bottles, (such as the homœpaths use) apparently lasts an indefinite time without losing inoculability. The author has distributed a quantity of this lymph to physicians in the surrounding country, requesting them to make a tabulated statement of the results, which he intends to publish with observations of his own.—*Med. Neuigk.*

A. G. D.

ANÆSTHETICS—THEIR PHYSIOGICAL ACTION AND THEIR COMPARATIVE SAFETY.

The *Medical Times and Gazette*, published at London, England, contains a very able article from the pen of Dr. P. Black, London, in which the physiological effects of the three anæsthetics in most common use is elaborately discussed. The distinguished author at the close of his paper draws the following conclusions:

"(1.) Ether and chloroform are administered on exactly the same physiological principles. A person is made to breathe air which holds in solution or admixture, a certain portion of ether. The brain or organ of physical consciousness becomes gradually intoxicated, and finally complete unconsciousness is produced.

This process seems very simple and intelligible. How can danger suddenly arise in conducting it? In the following manner: Air may be very highly charged, even saturated, with either of these substances, and in this state is very *pungent;* so much so that a person cannot breathe it, and if it is forced upon him he is stifled or suffocated in exactly the same way as if brimstone matches were burnt under his nostrils. Death would thus occur without either chloroform or ether having entered the body. Their action would be pernicious in a "negative," not in a "positive," sense. They do not enter into the body and destroy by their presence, but their pungency restrains the vital act of respiration, which will not suffer interruption, and in this way insures their exclusion. Thus, with a teaspoonful of either narcotic, I can at will destroy the lives of half a dozen persons in succession, and yet the narcotic shall not enter their bodies; or I may consume in six other cases a large quantity of either which shall without difficulty enter the body by the lungs, circulate with the blood, and simply produce sleep or unconsciousness.

This most important fact has never been fully recognized and incorporated in the teaching of our medical schools, yet it furnishes the key to a large majority of the fatal cases which have been recorded for many years in the medical journals.

A patient dies suddenly, not because chloroform or ether has too quickly entered into and thus poisoned the body, but because its entrance has been prevented by its pungent or irritant property, which has at the same time restrained the necessary respiratory movements.

If this be true, the condition of safety is to administer either narcotic in that degree of dilution at which it is easily breathed; and when unconsciousness is thus gradually produced, it may then be given almost at the point of saturation, for, as sense or consciousness is gradually lost, the breathing is no longer restrained by that pungency which was a source of danger in the first instance, and—though this last point is of comparatively little moment—the air will contain sufficient oxygen to satisfy the chemical requirements of respiration.

Some have thought that ether may be given with more safety than chloroform, and appeal to experience as being in their

favor; bnt this is erroneous, and it has been clearly shown that there is in reality no difference. Both are equally free from or obnoxious to danger, in accordance with obedience to, or neglect of, the precaution I have indicated.

(2.) The other anæsthetic of frequent use in dental surgery is nitrous oxide gas. This physiologically is altogether different from the last two. Having no pungent or irritant property, it is easily breathed, so that a patient cannot be suddenly suffocated by it, as by air largely charged with ether or chloroform. But during its inhalation the venous blood is not aerated, and increasing lividity, if other signs were wanting, would warn an operator to desist. Death might doubtless arise from extreme narcotism; but this can never be sudden. In the case of the other narcotics, the movements of respiration may be checked by a too pungent air, and asphyxia is the result."

THE following from the *Cincinnati Lancet and Clinic* illustrates the usual results attendant upon the replacing of severed portions of soft tissue, and the conditions necessary to be observed to insure a successful termination of the operation. The same conditions do not apply with equal force to the re-plantation of teeth, yet the suggestion of sustained temperature, or at least of restoring the temperature to the normal degree, before replacement, may be one of considerable importance in this latter operation. There is another point bearing upon the subject of the re-plantation of teeth, which may be introduced here for the benefit of our readers, although it does not directly relate to the subject matter of Dr. Boyland's paper.

It is well known that some portion of the peridentium comes away with the root at extraction. How long does the vitality of this replanted membrane continue? If the tooth is allowed to cool, and is kept out of the mouth several hours, does not this membrane lose the ability to re-unite with the portion from which it has been severed? If so, it would clearly be good

practice to scrape the root or roots *clean* before replanting; otherwise union would be retarded by the presence of dead tissue.

NOTES ON THE HEALING OF PIECES SEPARATED FROM THE HUMAN BODY.

BY GEORGE HALSTED BOYLAND, M. A., M. D., BALTIMORE, MD.

The experiment of replacing in position portions of the human body hacked from it either in duel, battle or accident, is of comparatively recent date. The result was so far satisfactory as to demonstrate conclusively that such parts replaced do heal, and not only heal rapidly, but bind themselves to the main body with surprising strength and rapidity; provided, always, that one or two cardinal points be strictly observed: 1st, the piece separated must be kept warmed to the temperature of the human body; 2d, it must be replaced, whether with adhesive plaster or the suture, or both, directly the flow of blood ceases. The following two cases occurred in the clinic of Dr. Maas:

In case first, in a duel with schlägers (a weapon something like a rapier, but with a flatter blade, blunt at the end) the left ala with a part of the point of the nose was cut off one of the principals—this piece, containing skin, muscles, cartilage and mucous membrane was cut square off; it was at once sewed on with fine sutures; between the sutures strips of adhesive plaster were applied and then over the whole point of the nose, in order to prevent evaporation and drying as much as possible, a patch of oiled silk and upon this cotton batting, with which the nose was also tamponed. On the third day the sutures were taken out and the piece found to be quite black; the whole epidermis sloughed off as a black crust, but under it the normal rete malpighii appeared, on one small portion the epidermis remained. After a time a layer of horny epithelium put out. At this juncture the report informs us that the patient was lost sight of for nine months. The profession are thus deprived of some very interesting facts regarding the successive stages of healing. At the expiration of nine months then, the wounded man appears upon the scene with the left nasal ala slighly flattened and with normal color, the surface of the portion that had been cut off made one with the whole side of the nose, no distinct line mark-

ing a cicatrix; on some parts of it (the old portion) the epithelium was a little thicker than on others, making a few very small rough places.

It is worthy of attention that on the third day, already when the sutures were removed and the epidermis had sloughed off, the part was firm in place. The sloughing of the epidermis is easily accounted for by the fact that the capillaries became contracted and, so to speak, dead, on account of their extreme fineness, during even the very short time that the piece was separated from the body. We would recommend in such an emergency a process carried out in a case that came under our own observation, viz.: that the separated portion be held in the mouth, if warm water cannot be procured, until the suture, and all is ready—thereby the animal heat would be retained and the chances for the sloughing of the epidermis materially lessened.

The second case, also the recipient of a wound, was a student in a duel with schlägers, out of whose nose a polygonal shaped piece was hacked, just above the point, thereby exposing *in extenso* both nares. The piece was only found after a long search, and after the bleeding ceased, placed in position. Likewise in this case the greater portion of the epidermis came off as a black crust. The piece when healed on, was bordered on all sides by a sharp-edged scar, its color being red and the part itself tumefied. The wound left on the nose was clean and even-bordered as regards the skin, while the cartilage and mucous membrane were separated irregularly and zigzag.

Nothing is said about treatment, and we must suppose it to have been the same in both, although the large scar and red color with tumefaction would indicate a less successful result than in the first case. The length of time that elapsed before the separated part could be found comes also into consideration, although adhesion takes place more readily after the bleeding ceases, the surfaces of small wounds like these being moist then with a gelatinous like substance composed of blood and serum.

As regards the healing itself it was a *prima intentio*, although the sutures were only removed in three days. In healing per primam in wounds in which pieces are not separated Bruns removed them in 24 hours.

As for the pathological anatomy, or more properly, the pro-

cess of healing, these cases illustrate undoubtedly that the vessels of the piece after being placed in position received in their lamina the blood from the several vessels of the borders of the wound on the nose. In unfavorable cases a hemorrhagic infiltration of the separated portion, which may be followed by mummification of the same, is liable to result. In the more successful ones, the epithelial covering is everywhere thrown off. In those again where the surgeon is especially fortunate, the circulation in the portion separated or in parts of the same can re-establish itself without any disturbance as regards nutrition. Of importance in the healing of wounds upon which transplantation may be carried is the proof here deduced by Thiersch, that in transplantation there is a direct flow of blood out of the granulation vessels of the main wound into those of the transplanted piece. It is remarkable that Thiersch in Reverdin's transplantation did not observe the sloughing off of the epidermis which is in general, the rule. Technically, where portions of flesh are severed from the human body, the above procedure may be followed.

CIVILIZATION AND SCIENCE.

When cultivated one-sidedly, natural science, like every other form of activity under the same conditions, narrows the mental horizon. Under such circumstances natural science confines our vision to what lies nearest to us, what is palpable, what can be directly apprehended with apparent certitude by the senses. It turns the mind away from more general and less positive considerations, and disaccustoms it to act in the region of the quantitatively indeterminable. In a certain sense we hold this to be a priceless advantage for natural science; but, where this tendency dominates exclusively, it is not to be denied that the mind becomes poorer in ideas, the fancy in images, the heart in sentiment, and the result is a narrowness, a dryness, and a hardness of mental constitution, abandoned by the Muses and Graces.

Again, it is a peculiarity of natural science that on the one hand it has a part in the highest aspirations of the human soul, while on the other by insensible gradations it passes into handicraft, into activities whose sole end is lucre. Under the ever-rising demands of every-day life, a steady deviation is inevitable. That side of scientific activity which has to do with the useful arts is ever, unnoticed, coming more and more into the foreground; generation after generation find themselves more and more bent on caring for material interests. Even the universal participation in the over estimated benefits of political life diminishes the respect for ideas. Amid the unrest which has taken possession of the civilized world, men's minds live as it were from hand to mouth. Who now has the time or inclination to go down into the deep well of truth, to plunge into the sea of the Ever Fair? Education, now-a-days, too often an unorganized patchwork, consists of individual facts plucked up by the roots, so to speak, useful, it is true, but dry and crude. Few now are concerned about the mode in which the truth has been discovered, or about the relations between things perceivable only in reascending to their origin—to say nothing of the charm of perfect form. Art and literature prostitute themselves to the gross and variable taste of the multitude, swayed hither and thither by the daily newspaper. Where fame lasts for only a day, one of the noblest incitements of human nature—the thought of being famous after death—ceases to have any effect. Hence the decay of intellectual production, which brings forth imperishable masterpieces only when the mind gives itself to its work with whole-hearted devotion and with patient fidelity. And if, as Fontenelle has said, industry is indebted for its quickening impulse mostly to pure science, even industry is compromised by what is in part its own work. In short, Idealism is succumbing in the struggle with Realism, and the kingdom of material interests is coming.

It is no surprise that this aspect of modern civilization should be most noticeable in a country where the creation of material resources and the removal of natural obstacles were for a long time of prime necessity; where an immigrant population had, in a measure, to begin a new life, and most of them had, as it were, burned their ships behind them; where no historic mem-

ories and literary traditions were available for stopping the tendency of the popular life, too exclusively directed toward the useful arts and acquisition of wealth. It is no wonder that America has become the principal home of utilitarianism. While at times the very first conditions of human society are there in dispute, it is in America especially that those existences come into being whose wealth, luxury, and external polish, contrasting as they do with their ignorance, narrowness, and innate coarseness, give one the idea of neo-barbarism. In view of this aspect of American life, which has been again and again portrayed by writers, from Sealsfield down to Bret Harte, it has come to be the custom to characterize as an *Americanization* the dreaded overgrowth and permeation by realism of European civilization, and the rapidly-growing preponderance of manufacturing industry. Later the starry flag has waved in a war for an idea, a glory which the tri-color has been wont to claim for its own—and then has, like your true mercenary, demanded its pay for service done. Still another starry flag may the land of the future confidently oppose to such reproaches as are implied in the term "Americanization"—the flag of its young literary honors, each star being some name illustrious in science, in song, or in story. However, the term "Americanization" is now naturalized, nor will non-Americanized Americans object to the employment of it, as most of them are quite ready to admit the weak point in the young giant's education which the term is used to designate.

But, in thus animadverting on American civilization, is it not a fact that we see the mote in our brother's eye, but perceive not the beam that is in our own eye? What of the resistance that ought to be made to the redoutable tendencies by our German civilization, ancient and firmly rooted as it is, when compared with the American? Unless we give way to one of our lastest-cherished self delusions, we must confess that we have already made such progress in "Americanization" as should give us pause. Germany is become united and powerful, and the longing of our youth to see the German name again respected by land and sea has been fulfilled. Who would find fault with such an achievement? But go back in thought to the divided, powerless, provincial Germany of our youthful days—

passing as it were from the cold splendor of the imperial city into the narrow streets of some old town in Middle Germany, with their overhanging gables, and the house-fronts hung with grape-vine and ivy—is there not something lacking in the noisy Present, with all its glittering and dazzing magnificence? Must we not, in the words of the "Schwalbenlied," exclaim, "Oh, how remote from me is that which was once mine!" In the revolution which Germany has undergone within a generation, has not the good been sacrificed as well the evil? Besides its vague longings, its futile struggling, its uneasy doubts as to its own powers, has not the German nation furthermore dropped somewhat of its enthusiam for ideals—its unselfish striving after truth, its deep and quiet inner life? Like a dream the short-lived bloom of our literature has vanished. As politics and natural science, with their harsh realties, have silenced the delightful *causerie* of the Parisians *salons*, so here, too, have they given poor entertainment to the descendants of the heroes of classic story and of romance. Goethe himself were he now a young man, would, in in all probability, leave "Götz," and "Werther," and "Faust," unwritten, and would rather practice in the Imperial Diet his power of public oratory, diagnosed in him by Gall, but which, during his life, he tested only with the "birds of Malcesine." With all the splendor of German science to-day, we plainly miss, in the rising generation, the noble passion which alone guarantees the continuity of intellectual effort. The recently re-awakened liking of the Germans for philosophic speculation simply proves the truth of the old saying—

"Naturam expellas furca, tamen usque recurret;"

but it is not calculated to quiet our apprehensions, with regard to the universally-diffused and rapidly-increasing indifference of our youth toward everything that they cannot see through and through, or that does not bring money or advancement.—DuBois Reymond on "Civilization and Science."—*Popular Science Monthly.*

REMARKS.—DuBois Reymond is, perhaps the most distinguished physiologist which the city of Berlin has yet produced. He deplores the utilitarian spirit which pervades America, and bewails the tendency towards a prevalence of that same spirit in his own land. This change, which is gradually spreading itself,

and which has already obtained a strong foothold in Germany and elsewhere among European nations, is called by the author of the foregoing article, "Americanization." We claim that it has received this appellation, not because itis peculiarly American, either in its character or origin; but rather for the reason that its growth has been fostered and its potency increased by reason of the character of our social and political institutions, as well as by the hereditary training consequent upon the settlement and peopling of a new country.

This craving for the real rather than the fanciful; this well nigh universal tendency among civilized peoples towards the utilitarian rather than the ideal, would have been recognized by the author as a quality pertainiug to the men of the times rather than to a nation, had he been as good an ethnologist as he is a phsyiologist.

In this country, circumstances have, from the first, tended to develope and strengthen that prëeminently practical characteristic which our author alludes to as purely an American peculiarity. That it would have acquired equal force and importance among any other people similarly circumstanced, may not be susceptible of proof, yet it seems a fair conclusion that such would have been the case.

We do not deprecate the existence of this utilitarian spirit; we rather rejoice at the giant proportions to which it has already attained; for we believe that it constitutes the ground work on which will be erected, in the not distant future, a nobler social fabric than any that has yet been known to history; and through whose agency there will be evolved a system of social science based upon the useful and the true, in which the hypothetical and the imaginary will be valued only in proportion as they are in agreement with established laws. Fact will then take the place of hypothesis, and demonstration that of theory.

Artificial Dentistry.

THE time is yet far distant when the mechanical element of our profession will be separate and distinct from the surgical. Such a division, in its completeness, would result in something very much different from what we now understand as "Dentistry."—*Monthly Review.*

PRACTICAL SUGGESTIONS TO CELLULOID WORKERS.

BY GUSTAVUS NORTH, D. D. S., SPRINGVILLE, IOWA, LECTURER ON THE PRINCIPLES OF DENTAL SCIENCE IN KEOKUK MEDICAL COLLEGE.

Various materials have been brought before the dental profession in the past few years for the purpose of making artificial dentures; and, perhaps, celluloid is superior to all that are used as a substitute for rubber.

The profession has been endeavoring to find some material that would free them from the annual tax that they are compelled to pay if they use the material called rubber.

Rubber will, no doubt, come into general use some time in the future, when it can be used as other materials are without the procuring of a license.

At present, celluloid is extensively used. It makes a beautiful looking plate, but is not likely to prove as durable as rubber.

Celluloid is derived from cellulose, a woody fiber, constituting the framework of plants. Cotton, hemp, etc., represent cellulose.

Hemp is the form of cellulose used for this purpose. It is manufactured into paper in the usual way, and the stronger the paper the better the celluloid. The formula of pure cellulose is $C._{6}\ H._{10}\ O._{52}$.

The paper is converted into pyroxyline, by immersing it in a a mixture of nitric and sulphuric acids for a certain length of time, when it is removed and thoroughly washed.

It still remains in the form of paper, but has been increased in weight about sixty per cent.

The pyroxyline is now reduced to a pulpy condition, and camphor, oxide of zinc, and vermillion are mixed with it. Celluloid is composed of Pyroxyline, 50 parts; Camphor, 20 parts; Oxide of zinc, 1 part; Vermillion, 0.3 parts.

It is then pressed and moulded into the forms in which we receive it.

Various kinds of apparatus have been introduced for the purpose of moulding celluloid plates, and, perhaps, this material has baffled the skill of dentists more than any other one material used in this branch of practice.

Talbot's hot-air apparatus is, perhaps, one of the best in use for this purpose, and if properly managed the material is easily manipulated. After the flask has been properly prepared with grooves or vents for surplus material, select a plate suitable for the case, and place the flask in the apparatus and tighten the nuts with thumb and finger, and apply the heat and let the thermometer indicate 200° or 220°F. Then gradually turn the nuts. If the alveolar ridge is thin and projects, this condition can be favored by using an apparatus that has two bearings, or, in other words, an anterior and posterior bearing; there will then be no danger of crushing the projecting portion of the alveolar border. In such cases, tighten the nut over the anterior portion of the model a little in advance of the posterior, until the flask is nearly closed. The model may also be set at an angle in the flask to obviate this trouble to some extent.

When the thermometer indicates 300° or 320°, the flask should be brought together and the heat should not rise above that point. If the work is properly executed the flask will be easily brought together. If either part of the flask should be closed, and the opposite portion a little distance apart; loosen the nut a trifle, perhaps a fourth turn, and the flask will come together with ease. If the plate should be a little large, and the flask hard to close; loosen one side a trifle and tighten the other; then reverse the process, and the flask will generally come together with ease.

While a plate is being moulded it should receive undivided attention. When the thermometer indicates 200° or 220°, the nuts should be slightly turned, but not much power should be

applied until the thermometer indicates 280° to 300°. The nuts should be turned alternately and the flask should be brought evenly together.

Celluloid plates should be made thicker in the center of the arch than the manufacturers are in the habit of making them, so that the material may be pressed from the centre to the circumference.

PRACTICAL HINT.—Place your vulcanite flask in a stirrup and screw-press, placing a block of spring rubber one and a half inches square and half or three-fourths of an inch thick between the flask and the iron disk and screw *gently* into position. Put the whole into hot water, turning the screw occasionally until the flask closes.—*Cond. from Am. Jour. Dent. Science.*

Clinical Reports.

GELSEMINUM IN ACUTE PERIOSTITIS.

BY DR. GORTON NICHOLS, CHICAGO.

CASE 1.—Mr. P——, suffering from an attack of acute peritonitis, presented himself at my residence one day recently, about 4 P.M., having had no sleep the previous night, face swollen, acute pain; the lesion occurred near the foramen of the posterior root of a "relic" of the second right inferior molar, which I had filled about a year previous. Through this I now passed with a nerve bit to the seat of disease; syringed with warm water and applied saturated solution carbolic acid and iodine; ordered bran poultice to face, hot foot bath, light supper and warm bed. Patient returned next P.M., much worse; increased swelling, intense general nervous irritability, low fever.

disrelish of food with slight nausea, insomnia. Prescribed gelseminum fluid ext. dose 3 gtt. in aqua; repeated each 30 minutes for 3 times, then to be followed by 1 gtt. in aqua each hour until sleep. I, by patient's request, called same evening; found him in a fine perspiration, with little or no pains; quite nervous, appetite renewed and he said he "felt as if he could go right to sleep," which he did soon after I left. The case now took a favorable turn, and in a day or two terminated in resolution.

Books Received.

Facial Neuralgia and the Visceralgia; their Diagnosis and Treatment. By J. Martine Kershaw, M. D.

The small work with the above title constitutes Part I, of a larger work in eight parts, on Diseases of the Brain and Nervous System. The work is of great value, but Part I is of special interest to the dentist. Facial Neuralgia is a disease about which but little has heretore been written. Dentists should avail themselves of all the information attainable, relative to diseases affecting the fifth pair of nerves. We commend this treatise to our readers as being the most valuable of any that has yet come under our notice, devoted to the consideration of these ailments. A careful study of this litte book will help the dental practitioner to a correct diagnosis of any case of facial neuralgia. The therapeutics recommended are homeopathic, but they relate only to treatment, and occupy but little space.

American College Directory and Universal Catalogue. Intended to be a complete educational directory. The second volume, though somewhat incomplete, is a valuable reference.

Bibliotheca Medica. A comprehensive catalogue of books, etc., relating to Medicine, Surgery, Dentistry, Pharmacy, Chemistry, etc. Published by Robert Clark & Co., Cincinnati, Ohio.

WE HAVE received the Annual Announcements of the following Colleges:

Philadelphia Dental College.
Maryland Dental College.
Ohio College of Dental Surgery.
Physio-Medical College of .ndiana.
Pennsylvania Dental College.
Boston University School of Medicine.
Western College of Dental Surgeons, Saint ouis.
Con 4a

Miscellaneous.

SALYCIC ACID AS A DENTIFRICE.—Pharmacy has its fashions as well as other things, and the present prevailing mode is salicylie acid. Dr. Buch, of St. Petersburg, deprecates its adoption as a dentifrice. A short time ago there was a warning raised against the use of charcoal. It had similar dental recommendations, namely, that it was antiseptic, and that as far as cleansing was concerned, it was most effective. But the microscope pointed out that every particle of carbon, in however divided a state. was a small crystal, which, acting by attrition, was hurtful to the enamel. While charcoal, therefore, was said to be a fine saw. salicylic acid is now stated to be a solvent, and accordingly to be abjured. Dr. Buch mentions that he was in the habit of using a solution of three parts in one thousand of salicylic acid, a lotion of such strength being fatal to bacteria. In a few weeks he felt a curious sensation in his mouth; the teeth appeared to become softer, and on the surface something gritty was detected, there being evidently a granular formation. The doctor believes this to be a salicylate of lime; if so, the use of the acid as a dentifrice should be discountenanced.—*London Chemist and Druggist.*

POISONING BY INK.—The *Rheims Courante* says that a scholar in the Oberlahnstein high school incautiously smeared his upper lip with ink. On this lip there was a small sore, and after some time it began to swell. The swelling rapidly spread to the neighboring parts of the face, and attacked the inner surface of the mouth. Delirium set in after two days, followed on the fourth by death.

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DENTAL JOURNAL,

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GENESIS.

BY HIRAM CHRISTOPHER, M. D., OF ST. LOUIS.

VIII.

The general belief as respects the value and importance of antiseptics in surgical as well as medical practice—a belief that seems pretty well confirmed by experiment—is based on the supposition that microscopic organisms do really occasion putrefaction. That they are the cause of some destructive diseases is a matter of experimental knowledge; and that they have some connection with putrefaction seems to be an equally well ascertained fact. It is hence, esteemed a matter of very great importance in surgical practice to destroy their germs, or prevent their action by means which are supposed to do one or the other. Since the contact of the air, and the consequent disposition of these organisms on an exposed surface, cannot be prevented, the effort is made to counteract their influence by antiseptics which are supposed to act in one or both of these ways. The success of the practice thus far certainly favors the views of Prof.

Tyndall and implies the correctness of his conclusion—that there is, and can be no putrefaction or decomposition of organic substances, if the presence or action of the germs of these organisms be prevented.

Now, as these living organisms are observed to grow and reproduce while in contact with organized substances, the inference seems evident, and, indeed, necessary, that the organic body affords them the food on which they grow. Their growth and reproduction prove that they nourish. And since putrefaction is a universal attendant on their presence, it is thought to sustain to the nutrition of these organs the relation of cause and effect. And since, also, experiments have shown that no putrefaction takes place when the germs of these organisms have been effectually excluded, Prof. Tyndall declares that they are the true, real, and indeed, only cause of putrefaction. This would affirm the absolute dependence of decomposition on the vital process of nutrition, as its cause. Hence, though putrefaction is not truly a nutritive process, yet it is dependent on it, and to that extent and degree, that the two processes are indeed inseparable. This is a grand generalization, and shows that life and death are much more closely connected in their phenomena than was ever known before. Such a relation or connection was not even suspected.

These things being so, the fact that decomposition is effected only through the nutrition of living organisms, has a very important bearing on the question under discussion; for if it be true—and Prof. Tyndall says it is—it shows that, as nutrition is necessary to the decomposition of organized bodies, the agency of living organisms is absolutely necessary to the return of the elements that constitute the fabric of these bodies, to their native realm. And the fact further shows the utter inadequacy of physical agents alone to effect this purpose. These things being so, the theory that assigns to physical forces the origin of living beings, is shown to be utterly absurd and supremely preposterous; for, if they cannot decompose an organized body, how insane to suppose that they can compose one;—that they can originate what they cannot even destroy! This is a most important and significant fact and suggests:

1. That organic bodies are much more stable in their composition or structure than has been generally supposed. We have

been led to believe, as heretofore observed, that organic bodies, and especially those of the quarternary series, are very unstable; that they readily, or spontaneously fall to pieces under the action of physical forces alone; and that the elements which compose their fabric, are held together by the presence of the vital power alone, their decomposition was regarded as a simple physical process, by which atoms seek their inorganic or natural relation, and as a gradual falling away from the organic to the inorganic. That any other different process was connected with it, either as essential or accidental, was never conjectured. The fact was not even suspected before it burst upon the mind as a discovery. There was no anticipation or conjecture that foreshadowed its approach. It came as a revelation, and presented the phenomena of death in a new light. It tells us that there is no death without life, no decay without growth, and no putrefaction or decomposition without nutrition and construction. As spontaneous generation has been proved to be impossible, so it now appears as equally well established, that spontaneous decomposition is also impossible. The presence and agency of a living agent are now proved to be necessary to both. The experiments of Prof. Tyndall seem to place these facts beyond successful contradiction.

But it may be urged that, if physical agents are not the exciting cause of decomposition, they are, at least, necessary to it; that living organisms cannot effect decomposition without their assistance. This is fortunately true, and is an evidence of an intelligence and wisdom that understood the nature of living organisms and their power for good or ill, and wisely adapted means to the end; and when we consider the vastness of the work of the organic world, we can but believe that nothing less than infinite intelligence and wisdom were adequate to make such provisions and adjustments as are presented in the phenomena of life and death. If no physical conditions or agents were necessary to the action of living organisms, what we now know of their power and agency would justify the opinion that all things had indeed, come by chance, since they would, if not affected by physical agents, be utterly subversive of the economy of nature. But it was wisely provided that excessive heat or cold should destroy the germs or prevent their action on organic

substances. They cannot live and grow except under proper physical conditions; and as physical agents, are, to a great extent, within the control of man, he can prevent these organisms from doing harm. But physical agents in such cases prevent injury by these germs, by producing such conditions as makes their growth impossible. Reduce the temperature to a certain degree, and there will be no manifestation of life. The degree of cold may not destroy the germs, but it certainly prevents their germination and growth; and as it is only by their germination and growth that decomposition is effected, so, when the vital functions are held in abeyance, no putrefaction takes place. The same result follows when antiseptics are used. How these act we may not know. They may not destroy the germs as fast as they fall into the putrescible fluid. They certainly render it incapable of fermentation or putrefaction, and very probably by destroying the germs in their germ state. To a drop of beef tea in which hundreds of bacteria were seen moving with the vigor of growth, I added a drop of a saturated solution of common salt and all motion ceased. The bacteria were killed. About a year ago I made a mucilage of gum tragacanth to which I added at the time some salicylic acid, and a few cloves. To-day, no organisms appear in it as far I can see. These facts show that we have the means of preventing the development of germs, and the decomposition of organic substances by the agency of antiseptics. Germs cannot develop and grow except under proper physical and vital conditions, and hence decomposition can take place only when these conditions are present. But this is no ground for denying their necessary agency in decomposition. On the hypothesis that physical agents alone are the causes of decomposition, the same or similar conditions are necessary. Oxygen will not combine with an oxidizable element except at a certain temperature; and heat alone was not regarded by the old theory as sufficient. Oxygen was esteemed as absolutely necessary. Physical conditions are, indeed, necessary to all forms of life, and hence the fact that they are necessary to decomposition, does not militate against the fact, that living organisms are the real and necessary agents in the decomposition of all organic substances.

In the second place, the fact that living organisms are the agents in the decomposition of organic substances suggests that

it was necessary at the beginning to provide for the complete return of the elements that constitute the organisms of living beings and the organic matter which they form, lest the world should ultimately become overstocked with living beings and organic substances, and thereby give rise to such a train of evils as would make the further introduction of living creatures undesirable or impossible. Such a special provision was imperatively necessary, since, as now discovered organic bodies do not undergo spontaneous decomposition on account of a natural instability of constitution, nor are decomposed by physical agents alone. Were they readily decomposable, either spontaneously, or by physical agents, it is hardly probable that this order of living organisms would have been created. If they were solely designed for the work in which we find them engaged, this work has proved sufficiently great in all ages of life on the globe to have justified their creation in such vast numbers. As it seems almost certain that organic substances cannot decompose without their agency, we may rationally conclude that they were designed for this purpose. It would, therefore, appear that only life can undo the work of life. So stable does its work appear, that it seems to resist, with the greatest obstinacy, even this agency. It yields only by degress. When sugar becomes the pabulum of the microscopic plant, it does not surrender its integrity at once. It grudgingly yields a part to nutrition, and surrenders a part to the inorganic world, and falls back to a lower body. It is composed of $C^{12}\ O^{10}\ H^{10}$, and in the struggle comes off only as alcohol $C^4\ O^6\ H^2$. The rest has gone to the the support of the plant, and into carbonic acid (CO^2). How long the alcohol will remain unchanged under the influence, or the ordinary action, of physical agents alone, we know not. So with the secondary products of the nutrition or putrefaction. All of them are not purely inorganic bodies; and just how long and obstinately they resist physical agents, has not yet been ascertained. As the less stable, or more complex, are not decomposed except by the agency of living organisms; and as no organisms have been discovered that feed on these secondary series, we might infer that these reach the inorganic world only by the excessive action of physical agents, as a high degree of temperature.

The nature of the process of the combination of elements in the organic kingdom, and by means of living organisms—cells for instance is that of food-making—*artopoiesis*. This is effected by plants, and in parts specially set apart for this work. The great mass of pabulum we now find in the world, or that has existed in the world from the beginning, was prepared by the leaves of plants, inorganic material undergoing in their structure, and under the influence of heat and light, such interochange between their elements as to form organic products, while a part passed back into the world of matter. In this, the process of *artopoiesis* resembles the process of nutrition. The secondary process is nutritive. The food passes from the leaf into the general circulation, and after contributing to the nutrition of the organism, disappears as pabulum; and then out of the process of nutrition come "formed matter," and partially and wholly decomposed matter.

The same are the results of nutrition in the case of microscopic organisms. As nutrition is a vital process, all living beings take part in the work of the decomposition of life's products, because nutrition is the natural means by which decomposition is effected. The microscopic beings come in as the last agents in the work, and seem to have been especially designed to complete the work left by the higher forms. This is a beautiful and wonderful provision, demonstrative of infinite intelligence and wisdom. Human reason, were it a thousand times greater than it is, could never have conceived such a thing; much less could blind and passive physical forces have originated it. A system of reproduction was absolutely necessary to the end the author of nature had in view. This system itself was a conception beyond the range of human reason. There was no phenomenon in the inorganic world that could have suggested it, had human reason been assigned such a work; far greater is the ultimate purpose contemplated by the system, and which lay so many ages in the future. Besides, the actual working of this system was beset with difficulties of a very serious nature, and which rendered it imperatively necessary that such evils should have been provided for; that means should have been provided, which would effectually or in part mitigate or prevent them. Such a provision was made at the beginning; and there is no better or more convincing evi-

dence of infinite intelligence and wisdom than the provision that ordained that the evils should be mitigated or prevented by the same means that gave rise to them. This provision was living organisms. Nutrition underlies the processes of growth and reproduction. It is the latter that gives rise to the evils of overproduction and excessive accumulation of organic substances, and nutrition is the means by which these results are prevented. It consumes one fabric while building up another; but it can use and does use but a part of the nutritive material. The residue appears as inorganic matter, or of organic bodies lying just without the realm of matter. Living organisms are so constituted that life products are necessary to their growth, and when they mature, they reproduce. Nutrition and reproduction are complimentary of each other; the one is dependent on the other. So also reproduction and decomposition. The former supplies the deficit created by the latter, and the latter regulates the quantity of supply; but nutrition is the substratum of all these processes; the function on which rest reproduction and decomposition. These conclusions seem well confirmed by the phenomena of fermentation and putrefaction, heretofore regarded as disintegrating processes, but now known to be nutritive. As, then, living organisms are the agents by which the decomposition of organic bodies is effected, we find that they accomplish their work through the natural operation of their vital functions.

In the putrefying carcass the fly lays its eggs. These, finding a suitable nidus in the fluids of the carcass, hatch, and larva are born. Thousands of these appear in various parts of the putrefying body, and we may observe them from day to day. We can see that they grow, and we hence infer that they feed on the carcass. There may be feeding on the same carcass, and at the same time carrion birds or quadrupeds. All these agents of destruction are visible to the unassisted eye. But if we examine a drop of the fluid taken from the carcass under a magnifying glass, we perceive that the drop of fluid swarms with living forms as active as the restless larva. All these living beings are engaged in the destruction of the carcass, and long after bird and quadruped and larva are gone, the bacterium may be found finishing the work of consumption; and finally only the bones are left. These being inorganic matter, share the fate of all such sub-

stances. If no bird or quadruped or insect had taken part in the work, the bacterium alone would finally accomplish the work; but after much longer time. If the presence of bacteria be prevented, what happens to a vial of an effusion of a part of the substance when properly prepared and hermetically sealed, as detailed by Prof. Tyndall, will happen to the whole carcass. If all other scavengers are excluded, the whole body remains; so that without the interference of these scavengers the reproductive system would long since have filled the earth to repletion with its products. It would appear then, as a demonstrated fact, that the destruction of living organisms is affected only by means of living organisms. Nutrition is both a constructive and destructive process. It destroys in building up, and in building up is preparing the material of other living organisms, they in turn to repeat the process that has been going on since the creation of the first plants, the primary artopoietic organisms; the beginning of life and all its phenomena on this earth. On the work of the leaves of the plants primarily rests the life of plants and animals. Through the operation of the reproduction system comes the production of individuals, to which there is no practical limit but the supply furnished by the leaves of plants, and no protection against the evil of over-production but consumption. Such is the constitution of nature, a work of infinite complexity, and yet one of the greatest simplicity; a work that could have been designed and executed only by infinite wisdom and intelligence.—*St. Louis Medical and Surgical Journal.*

WHY DO OUR FILLINGS FAIL?

DR. J. D. PEARCE, OF IOWA CITY.

[*A Paper read before the Iowa State Dental Society, July, 1878.*]

Why do our fillings fail? This is a theme that has commanded the earnest solicitation of riper minds than the one before you.

Why did this fail? is a question that has engaged the serious attention of men in all departments of life. When men build structures that fail to serve the purposes for which they were designed, they very naturally ask themselves this question: Why did it fail? So with the man of science: When he finds that he has failed in some great problem, he looks over the ground again to find wherein he has made the mistake. It may be the man who administers to the sick: he has properly diagnosed the case and given the right medicine, but it fails to have the desired effect; and how very naturally comes the question, fraught with intense anxiety, why did it fail? So, pertinent also, is the question to us. We have just completed a fine gold filling: It has required skill, patience, and hard work; we admire it; we love to linger about it, and show it to our special friends; but after awhile it returns to us in some secure corner of the old pocket book; it has not served the purpose for which it was intended. Then the question recurs, why has it failed? Some one says the anchorage was not good; another says there may have been a leak somewhere; others say it was the result of "oral electricity," or electro-chemical action. Still other reasons might be offered, showing that we are not harmonious as to the primary causes of these failures. Hence we are not satisfied to rest. And thus it is why this question is the uppermost in the minds of our specialty to-day; we are thus forced to think and search. This is right; it is the moving power; it sends us onward and upward. It is a fact, without investigation there would be no progress in science.

Have you ever seen the field of research more thoroughly plowed and dug over than now? Why is it? Men everywhere and in everything find that in order to stand abreast with the advancement in their own avocation in life, they can no longer stand around with their hands in their pockets and take in, simply by absorption, the life of their calling; but they are awakening to the fact that they must go out and dig for themselves.

Hence, we see men everywhere shouldering their picks and tools and entering the field. Here they come in contact with weapons of other men, and they clash; thought with thought; mind grapples with nature; new things are discovered; these lead to other and perhaps severe contests; greater thoughts with still greater. And thus it goes on: each discovery leading to further research; until the mind of but small compass, being expanded little by little, is enabled to grapple with the gigantic questions in nature; never at rest; never satisfied; still reaching out into the unfathomable abyss beyond for more light. As evidence of this and as an aid in solving the question before us, let us glance for a moment at our past. And we need go no further back than within the vivid recollections of some who sit here to day. There were men, who, before the advent of hard gold and mallets, inserted gold fillings—after some fashion—that failed not; fillings that have saved teeth; fillings that have stood as living monuments of praise, attesting to the skill of the hand that made them. Some of these old fillings come to see us once in awhile, simply, we suppose, to show us that they are in a state of perfect preservation. Do you say these are but temporary? Shame on the man who would call them such, simply to bolster up a petted theory of doubtful foundation. But while some poor fellow was working away at one of these old fillings, with the sweat of an August day rolling from his brow, and with anxiety drawn up to the highest tension (while he was forcing the gold into the cavity with elbow grease) for fear his plugger would slip and plow up the soft tissue, Genius suggested to him to use less hand-pressure and hit his instrument with something. He instantly acted upon the suggestion; thought it all over; and thus sprung into use the mallet. With this we thought we could do better work; save our patients

broken necks, and live longer. But then we quarrelled about the kind of a mallet we should use. Dr. B thought A's mallet was too light: C increased the weight of B's, and thus it ran, until we have steel and lead mallets of from six to twelve ounces weight; so heavy as to frighten the patients upon whom they are used; and we think justly. But we did not yet, save all the teeth; fillings still failed. But genius stepped to the front again, and suggested to the mind still reaching out for something better, to anneal the gold, when the different particles will weld together, and the whole become a solid compact mass. And from this sprang into existence all the forms of hard gold. Then we cried "Eureka, Eureka;" we will now save teeth; with this cohesive gold and the mallet, we certainly can make fillings that will not fail. But we find they do fail.

And when we remember the extreme to which we have run with these things, we ask, is it much wonder that fillings, made out of 240 gold and with twelve ounce mallets, fail? Is it not astonishing, that the teeth into which they go, retain any vitality? We repeat, is it not remarkable that any of them survive? But these thoughts bring us back to the original question:—Why do our fillings fail? Why cannot we with the lessons we have learned from the past; the advice and councils of the hoary heads and withered brows, whose strength has been spent in the front ranks, and with the advantage of all improved appliances for facilitating and perfecting all our work, make fillings stick? And, it is to this question, the question of all questions, that all eyes are now turned. We may not be able to fully answer it; we rather think our pen is not adequate to the task. We may not be able to suggest anything new, for many of the reasons for failure that we may refer to, will perhaps seem to be old ones that have been discussed by other and abler pens than ours. But you know the scriptures teach us to keep the truths constantly before us lest we forget them. "Bind them about thy neck that they may be with thee continually."

Very many of the causes of failure, we are all agreed upon; but there are some alleged reasons upon which we split in twain. And, in this discussion we necessarily come in contact

with these mooted questions. And very prominently amongst these, stands out the one labelled "Oral Electricity.

This question has been very ably discussed, in various articles, by Prof. Chase and others. And while in the main, their investigations agree; yet, in their conclusions, they radically disagree. And upon this disagreement hangs the most vital feature of this whole question, to-wit: the relative merits of gold and other materials for preserving teeth. Chase, Palmer, and Flagg conclude from certain experiments, that gold—considered electrically—is the poorest preserver of teeth. While Bridgman and others conclude, from the same class of experiments, and upon the same hypothesis, that gold is the best preserver of teeth. This question very naturally divides into two sections; Thermo and Voltaic electricity. The first of these every Dentist is more or less acquainted with, and has observed its manifestations in teeth containing large metallic fillings in close proximity to a live pulp.

The pain experienced when the tooth is subjected to sudden changes of temperature, is due to an electric current, from the inequality with which gold and tooth substance conduct heat.

But it is the second division, "voltaic electricity" upon which we separate. This is the question—the entering wedge. Not, that there is no such thing as "oral electricity," for this must be admitted; indeed, to deny it a man must close his eyes to scientific research; for it is a fact in Chemistry that will not be gainsayed, that when two substances,—even two chips—are submerged in a liquid, and one is decomposed more rapidly than the other, that electricity is set in motion. But this question is so universally accepted by scientists that its discussion in the light of these investigations is but a waste of time.

And we simply observe, as we leave this feature of the question, that there may be, and probably is, a current of electricity generated in a tooth filled with gold or any other metal, when the reaction of the saliva is acid; but of so small an amount, when the tooth is full of vitality that it would require a very delicate galvanometer to detect it.

When we connect such a tooth, under such circumstances, with a galvanometer, by the ordinary insulated copper wire, and the needle is deflected, do you say that this current is from gold

and enamel? Or do you not rather say that it is a compound current sent out from the combined action upon the gold, copper, and enamel? Then there are other difficulties to contend with, such as the different electrical conditions of the atmosphere, and the different relations of metallic substances to the galvanometer; that, taken altogether, render the accuracy of the result very uncertain; so much so, that we place but little reliance on the results of any experiments of this kind, unless they are conducted in an isolated room, with an instrument so arranged as to make due allowance for the electrical changes in the atmosphere, and free from all metallic influences except such as are used in the experiment. And then, we should not allow any other metal to come in contact with the liquid except such as was used in the filling. With the result of such an experiment we might be satisfied.

But the vital question we have just reached: Does electricity break down organized tissue in the sense in which it is alleged? We are aware of the fact that a current of electricity from a voltaic battery, is supposed to break down, destroy, and wholly remove from the body, growths, such as tumors; and that it is frequently resorted to by physicians for that purpose. So also are we aware of the fact, that electricity is used to increase the vital energies, and even in some cases restore lost vitality. Turn in which way you may, you can but see in all nature the destructive influence of this element; yet you cannot close your eyes to its energizing and vitalizing influence in things around you and in you; indeed, it is maintained by some, that our very life is dependent upon this principle.

But the advocates of the theory of "oral electricity," allege that the pits or leaks, around the gold fillings, are the result of voltaic electricity; that the gold being, in a negative state, and the enamel positive, being in contact, that in the presence of saliva, latent electricity is put in motion, and the gold being a good conductor, while the enamel is a bad one, the electricity is thus interrupted in its motion, at the line of contact, and burns out. But our Chemistry teaches us, that in the voltaic battery, chemical decomposition precedes electrical action; and we ask, how is this? We learn, that to have electrical action you must first have decomposition; and this follows the action of the affinity that

one substance has for some element contained in some other substance. And the moment you expose a substance to the deorganizing influence of some other substance, and decomposition commences, then you have the electrical manifestation; and not until this force, which we call chemical affinity, acts, do you observe any such manifestation.

But we are met at this point, with the theory, that chemical action is entirely dependent upon the different electrical conditions of the substances brought in contact. This may be so; we are not fully prepared to deny the allegation.

We are aware that stronger pens than ours, support the theory; but we have failed to find experiments, so conclusive as to fully satisfy us that the theory needs no more support. Let us for a moment put the theory to a practical test. First, let us restate the premises: Chemical action depends wholly, upon the different electrical conditions of the substances brought into contact. That in every tooth filled with a metal, we have a voltaic battery ready for action; the gold negative, the enamel positive; gold a good conductor, enamel a bad one; hence, when in operation, the latent electricity is put in motion, which is interrupted at the line of contact of gold and enamel, and burns out. Now we believe the grounds are fairly stated; therefore, keep it in mind, while we look at the experiment. And this one will be sufficient; for the result here obtained, under the same influence, would be obtained in a thousand others. This tooth was perfectly filled, and filed down, and polished, until, under a strong magnifying glass, there were seen no pits, bruised enamel, or other imperfections. It was then suspended in Squibb' acetic acid, of the strength of one ounce acid in twenty-three ounces pure water, where it remained undisturbed for fourteen days. In order to support the foregoing conclusions—at least the last one—it must, when removed from the liquid, show the enamel eaten out into small pits, or a continuous groove, formed around the gold fillings, where the electricity had burned out; thus showing decomposition here, and not elsewhere; or a greater decomposition here than elsewhere. But the tooth presents no such appearance; and out of quite a number of like experiments, we have found no such condition. But we do see in this one, and all others, very striking evidence that the entire surface of the tooth was acted

upon alike. So that we see in the tests, no support for the second proposition; neither do we see any such manifestation, in all our observations, of failing fillings in the mouth.

With gold fillings, we generally find the first signs of failure, manifested at some one or two small points; while the rest of the line of contact is perfect. And to say that these are the result of a difference in the polarity of gold and enamel, is to affirm a proposition, that, to say the least, is not very tenable. We believe that experiments, and general observation will support us in the conclusion that they are not evidence of opposite polarity, but that they are proof of imperfect work; either in not thoroughly removing diseased dentine or enamel at such points, or in an imperfect adaptation of the gold to the tooth, or a misguided plugger, or a failure to perfectly finish at such points. When these imperfections occur around gold fillings, acid food, will be forced into them, decomposition of such deposited substances takes place, and chemical action upon the tooth structure is increased. That the latent electricity, put in motion by this chemical decomposition of tooth substance, may still further accelerate this disorganization, we are not prepared to deny; but there is in a living tooth a force that most certainly, to some extent, counteracts this external influence. But this phase of the question we will not discuss in this paper: Dr. Campbell, in the Missouri Dental Journal, has very ably argued this point. But we wish to call attention for a few moments, to another class of experiments reported by Dr. Bridgman, in support of the first proposition; that chemical decomposition is *wholly* due to opposite polarity. He says: "A stout copper wire placed in sulphuric acid, so that one end is immersed in the acid while the other end stands out in the atmosphere, and allowed to so remain for a given time, and then removed, shows the portion of the wire at the surface of the acid corroded about half way through, while that portion of the wire *above* the acid was coated with sulphate of copper, but in greater quantity at or near the surface of the acid, and gradually diminishing as you remove from the acid upward; while that portion of the wire that is immersed, is simply corroded into pits and furrows, gradually decreasing in extent as you remove from the surface downwards. He jumps at the conclusion that this is all due to the

atmosphere changing the polarity of the wire, making one end positive and the other negative, from the following: "A similar wire *wholly* submerged in the acid so that no portion of its surface is exposed to the atmosphere, remains for many months without loss or any chemical action upon it whatever; but the moment the least part of the surface becomes exposed to the air by evaporation of the acid, chemical decomposition commences. The rational of these experiments is, that the acid has no affinity for the copper, until the wire is first polarized." This looks like very conclusive evidence in support of the Electro Chemical theory. But let us look at the same experiments on another hypothesis. First, we observe that the copper wire *wholly* submerged in sulphuric acid of normal temperature, remains indefinitely without apparent change. But the moment you raise the temperature of that acid to boiling heat, *rapid* decomposition ensues, and in a short time the copper is all dissolved. If this was the result of the wire being polarized, what produced the polarization? Now suspend a copper wire *over* sulphuric acid of normal temperature, in an open bottle, so that the lower end of the wire will come within three-sixteenths of an inch of of the surface of the acid, and you will soon observe the sulphate of copper distributing itself over the surface of the wire, but in greater quantities at the lower end, and gradually diminishing as the top is approached.

Now, it will be noticed that this is just what is seen in so much of Bridgman's wire as is *above* the acid. Now, the question again; was this wire that did not touch the acid polarized? or does this class of experiments depend on some other principle? It is well known that when sulphuric acid is mixed with water, that the mixture becomes quite hot; so when the surface of this water is exposed to the influence of the atmosphere, it boils off into a fine spray and becomes diffused in the atmosphere, and the further the spray is removed from the hot surface of the acid, the greater is the diffusion, and the lower the temperature. It is also known that heat accelerates decomposition, and that some substances remain undecomposed, until the temperature is raised, when decomposition immediately commences.

This we have seen fully demonstrated with the copper wire submerged in sulphuric acid. Now, with these facts before us,

let us return to the experiments. Cannot we see, that as there is the greatest heat at the surface of the acid, there must be the greatest decomposition at this point, sufficient to cut the wire, as has been shown? And the further the wire is removed from the heated surface of the acid, the less heat, and consequently a more diffused sulphate deposit?

In these experiments it was also shown that the increased moisture of the atmosphere increased the deposit; for when they were conducted in a dry atmosphere, the deposit was slow, but when made on a wet day the deposit was quite rapid. But, since we have taken up more time on this feature of the question than we had intended, we shall not have time to discuss another class of experiments showing the relative loss in weight of different materials, used in filling teeth, in the presence of different liquids, as reported by Prof. Chase.

We simply state that we secured a set of delicate scales and entered upon this series of experiments for our own satisfaction. But so far, we have failed to get results that fully satisfy us that the Prof's conclusions are correct. Sometimes our specimens, which were reduced to exactly the same size and weight, showed, when in contact with gold, a greater loss than when in contact with Fletcher's alloy, and other filling materials. Again, two sections of dentine, cut from the same tooth, and reduced to the same size and weight, were suspended in Squibb's acetic acid of the strength of one oz. of acid to twenty-three oz. of pure water, in separate bottles, one in contact with gold and nothing in contact with the other. Both remained the same length of time, five days—when they showed the same loss,—six centigrams; hence we conclude that the results we have obtained, are not sufficiently uniform to prove anything. But *one* thing *was* clearly proven; that it is very difficult to obtain exactly the same weight of the same thing three times in succession. Another thing is prominently brought out, in all our experiments; that as the strength of the liquids into which the specimens are thrown is increased, so is the loss in weight increased.

Now, since these experiments to which we call your attention, as well as some others to which we have not alluded, seem to sustain us in the conclusion that chemical action is *not wholly*

due to polarization; but that the electrical manifestations of the oral *voltaic* batteries may be due to chemical decomposition, for we find as the strength of the deorganizing agent is increased, so is the rapidity of the decomposition. Inasmuch, therefore, as the electro-chemical theory fails to furnish us with an adequate primary cause for decay around our fillings, let us turn our inquiry in another direction. It is generally claimed by those who oppose the electro-chemical theory that our failures are chiefly due to a want of thoroughness. It needs no argument to satisfy any honest, observing dentist, that herein lies the secret of very many, and perhaps *most* of our failures. But for some years past we have been largely experimenting in the mouth with such things as 240 gold, deeply serrated pluggers, heavy mallets and other trash that have proven unfit agents for preserving the teeth.

While we would not in the least discourage the practice of experimenting where actual harm may not follow; yet, while we may have intended thoroughness in every case, may we not reasonably expect *some* failures to come from so many experiments? Cannot we find a ready solution of this question in this one thing of itself? Just for one moment look at your early experience with cohesive gold. How many times you have failed to work it into a cavity as you wanted to; work as you might the thing would turn upside down in spite of you; and finally, when the plug was finished, you was not satisfied with it. You had failed to perfectly adapt it to the walls of the cavity, and you knew it; you thought at the time that it would be better to remove it at once, and put in an old fashioned plug, until you had learned more about this "sticking stuff;" but you got your fee and suffered the plug to go out, thinking that if it ever failed the patient would return. Unfortunately the case dropped into the hands of another dentist, who marked it down against you and finally it turns up as an argument against gold as a filling material. Do you say that this is simply imaginative, and has no foundation in fact? How many of these things have returned to your own hands, when you *knew* that the trouble was just what we indicate? Need we say more to satisfy this intelligent body, that many of our failures are due to this cause alone? Again, did it ever occur to your minds that

there might be sufficient cause for failure, in case we had not correctly diagnosed? or if we had, the patient happened to belong in a certain neighborhood where we were, just at that particular time needing a little advertisement, and we thought we could make something shine that would stay three or four years, when, if it came out, we would be so boosted up as to be able to counteract the damaging influence on some hypothesis—perhaps oral electricity?

Our business is, in many places, reduced to a kind of barter and traffic system, so that it has become quite fashionable for people to go shopping amongst the dentists. Hence prices tumble, until a man who has a family can scarcely get enough out of his profits to support it. Therfore he works rapidly; makes haste so as to get through with just so much more work, and in making haste he makes waste. So we see failure coming from this source, and a number of others that we have not time to dwell upon, such as the improper use of the mallet, the improper use of gold, the use of deeply serrated pluggers, contour fillings in grinding surfaces of molars and bicuspids, and the manipulation of amalgam in filling the cavity. But we fancy we hear it said that we will not materially disagree upon these being sources from which we get many failures; but why is it that gold in the hands of the best experts, sometimes fails to preserve the teeth? We ask, are they not sometimes caught—unaware perhaps—making haste? Do they never make mistakes? Do they never experiment with new forms of gold, in the mouth? But you say if these failures generally come from a lack of thoroughness, why are you not always thorough? We say, this is no argument against gold as a filling material; simply because a man is not always thorough is no evidence that he *may* not be so. What then is the remedy? First, adaptability of the man to the business; then his thorough preparation for it. Not that he should simply obtain a diploma, and display a fine case of instruments in a dazzling office; but that he should thoroughly understand his business. And that he should be thorough in the treatment of his cases, and very thorough in getting into a cavity, and very thorough in getting out with whatever may come out; and thorough in the finish after he gets out, for just at this point he may fail, though all else be perfect. Let him on the reception

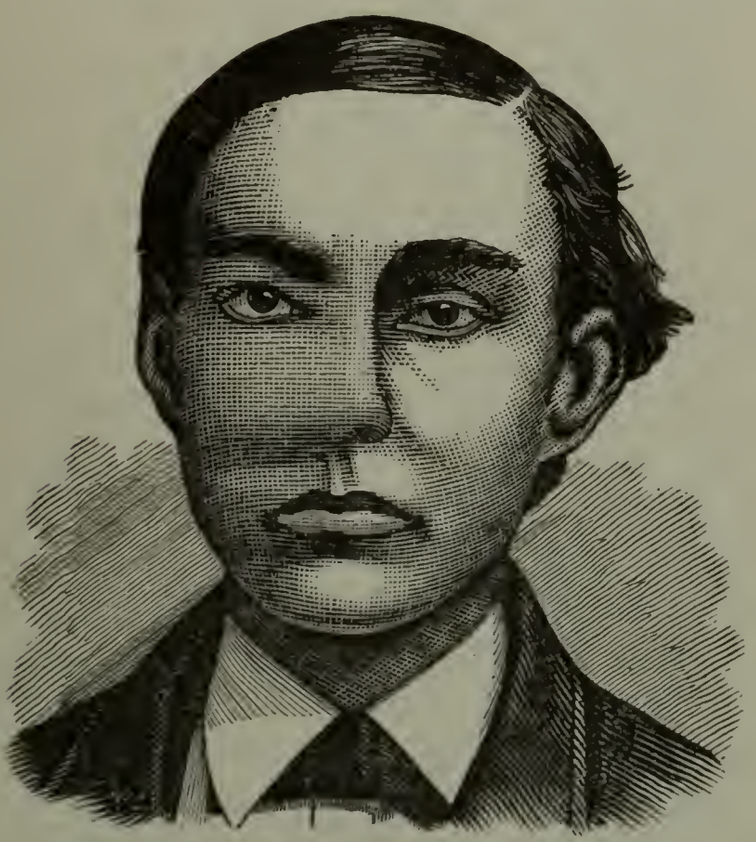
of new forms of gold, or new principled instruments, test them first out of the mouth, and never approach a living tooth with them until he has mastered their working qualities. We would bury all trade and traffic that stimulates competition in prices, and encourage competition in excellency of work at reasonable prices. We would make all men work slowly; we would have the word printed in bold letters, and hung about their necks during all office hours; for there is a halo of glory always hovering around the productions of the slow, careful workman. We would throw away all pluggers with deep serrations; they are not necessary in working soft gold, and are a curse with hard gold. We would make men mild and gentle with the mallet; many teeth have handed in their checks, given up the ghost, under the blows of this instrument of torture. We would make men use more soft gold in approximate cavities of molars and bicuspids. We would make men more thorough in tracing out fissures, and desist from so much contour in the grinding surfaces. Nature sometimes does a fine job here, but many cases are found where a thorough dentist could surpass her excellency, in making a surface that would resist the ravages of those influences that linger about these multiple cusps. Finally, we would combine the virtues of the past with the excellencies of the present. With soft gold and the modern method of preparing cavities, we can make better fillings than we did twenty-five years ago. But we cannot do without hard gold; it has a place in our art that we cannot ignore. We cannot make permanent work in all cases with either one or the other, any more than we can cure all ailments of the body with quinine. Hence, the dentist must be discreet; he must have judgment; if he simply works by rule he is a failure; if he lacks physiological and pathological knowledge he is a failure. And now, after we have thoroughly prepared a man, we would put him upon trial for five years and if he failed to bring forth good fruit we would rout him out of our camp.

Brethren, in conclusion, let us go hence pledged to more thoroughness in all our work; to be better dentists; to be careful, gentle and kind. Let us strive to see who can work best, ever remembering that the eye of an intelligent public is upon us, watching for the men who are intelligent in their profession,

thorough in their work, performing it with gentle hands and kind, soothing words, cleanly in their persons and apartments, temperate and chaste in all their habits.

CLINICAL SURGERY—NASO-PHARYNGEAL POLYPUS.

BY S. B. PARSONS, M. D., ST. LOUIS, MO.



[The above cut, although not faithfully representing the extreme deformity as it existed in the patient, yet it is a pretty good likeness of one case upon which I operated, detailed as follows:

H. M——, æt., 19; first noticed some obstruction of respiration through the nose, "a stuffiness," eighteen months ago. Thinking it a cold or catarrhal condition he paid no attention to it for some time, until it began to effect his breathing during sleep, which was so loud and labored at times that it annoyed his parents in a distant part of the house. Medical aid being sought, the physicician to whom he applied promised

a speedy cure, but a year's faithful trial convinced him that it was not so easy a matter, as he was constantly growing worse; respiration through the right nostril could be effected only by great effort; there was a constant feeling in the throat and posterior nares as though something was filling the cavity, creating a frequent desire to blow the nose or *hawk* into the throat. He had experienced occasional attacks of epistaxis which came on at times without any apparent cause and unheralded, and to such an extent was the loss of blood, that he became quite pale and debilitated. In February, 1878, he applied to me, and upon examination I found the following conditions: complete obstruction of the right nares and very limited respiration through the left nares; soft palate pressed forward, presenting a convex anterior instead of a concave surface, as though a round ball had been placed behind it forcing it forward; the posterior border of the hard palate was only *one-half inch* behind the anterior palatine foramen; the vomer and perpendicular plate of ethmoid were pressed toward the left side, close to the outer wall of the left nares; dorsum of nose considerably flattened, and orbital cavities separated to the extent of two inches; right nasal bone elevated and bulged outward towards the right side; right malar bone largely projecting forward; right eye-ball very prominent; no tenderness in any of the external parts; constant flow of thin, grayish discharge from the right nostril. Through the speculum the anterior end of the tumor could be seen, having a red appearance, with delicate whitish lines crossing it in various directions; tumor not visible in the throat except by raising the velum palati, which then revealed an oblong shaped body, dark red in color; by passing the fingers into the pharynx it could be felt firmly attached to the basilar process of the occipital bone; also to the internal plate of the pterygoid, and along the outer wall of the right nares; sleep very disturbed; appetite and digestion poor; complexion dirty-white, pasty; pulse, 104; temperature, 99°; strength reduced, and perspiring constantly.

It being evident that no treatment short of a surgical operation could be of avail to relieve the patient, on February 10, 1878, assisted by Drs. Vastine and Ravold, proceeded to remove the growth. Commencing at the inner angle of the eye, an incision was made and carried downward alongside the right

nasal ala, then curving inwards to the median line of the upper lip, terminated at the vermillion border of the latter, completely dividing it down to the gums; the right lip and cheek were then dissected up as far the lower edge of the orbit, thus exposing the malar bone, the front wall of which was cut away, bringing into view the antrum and as much of the tumor as it contained. It required but little effort to detach the growth, which was cut off at the orifice of the sinus. The floor of the orbit as well as the anterior wall of the antrum were found to be exceedingly thin where the pressure of the tumor was greatest. The nasal bone was then divided by bone forceps at its junction with the maxillary bone, and along the roof of the nose and lifted upwards until the nasal cavity was seen. The tumor occupied the whole of the passage as far forward as the orifice of the antrum, but its attachments, quite firm, were confined to the outer wall. As much of the mass as could be reached was removed by the scissors and cutting forceps; strong nitric acid applied to the surface; the nasal bone was returned to its place; the flap composed of the cheek and lip carried into its natural position and silver sutures used to retain the parts together.

The most difficult part of the operation was yet to come—that of removing the tumor at the base of the skull. The mouth was widely opened by a Whitehead gag, and the soft palate completely divided from before backward. Curved scissors, the wire ecraseur and cutting forceps, were all brought into use before this was accomplished. The hard unyielding nature of the tumor, its location, the difficulty of getting at it, all conspired to render this part of the operation extremely tedious and slow. After all the morbid tissue that could be seen or felt had been removed, strong nitric acid was applied thoroughly over the surfaces to which the growth was attached. The sides of the soft palate were drawn together and held by three silver sutures; the operation wound on the face dressed with carbolic acid and sweet oil; a facial bandage applied, and the patient returned to bed.

During the operation the hemorrhage was frightful to behold and seriously interfered with its progress; at times necessitating a complete interruption and the application of styptics to control it. A large quantity of blood passed into the stomach and frequently excited vomiting.

On the third day after the operation erysipelas appeared in the face, first showing itself in the incision on the nose, and rapidly spread to the right and left and to the forehead until nearly the whole face was implicated. The pulse rose to 160, temperature 104°; the face largely swollen; both eyes closed; delirium, etc., continued in a variable degree for eight days, then gradually subsided, and convalescence continued uninterruptedly till recovery was complete. During the attack of erysipelas, the stitches in the face and mouth gave way and were removed, leaving the wounds gaping and discharging a thin ichorous fluid. Applications of Belladonna, externally, were applied freely, combined with Belladonna, Rhus Tox, Apis, Arnica, and Sulphur internally, constituted the sole medical treatmeut, and beef-tea, milk, and cold barley water the dietary regime. As the inflammation in the face subsided, narrow strips of adhesive plaster were carried across the wound to hold the lips together, and there retained until union was perfect. One month afterwards the cleft in the palate was closed by paring the edges and approximating them by three silver wire sutures, using a strong solution of carbolic acid and glycerine as a local anæsthetic, which answered the purpose admirably, the patient being scarcely conscious of pain.

DIAGNOSIS.

BY DR. L. C. INGERSOLL.

[*Read before the Iowa State Dental Society, July, 1878.*]

Diagnosis is the art of detecting disease through the interpretation of symptoms. Anything is a symptom that foreshadows, is the result of, or in any way is a manifestation, expression or sign of disease.

Diagnosis is the most comprehensive science relating to the practice of dentistry. It includes pathology, because it is a

careful application of the principles of pathology to specific cases. It includes anatomy, because disease is localized in organs, structures and tissues of the body—affects contiguous parts and traverses to remote parts over nerve and vascular connections, which must be understood in detecting disease. It includes physiology, for no one can detect deviations from normal conditions and function unless he knows what normal performance of functions are and knows well the economy of life and health. It includes all except therapeutics, which is the next step beyond, and is one of the dependencies of diagnosis. There can be no rational treatment or cure of disease without a correct diagnosis.

The word diagnosis is derived from two Greek words—*dia*, through, and *ginosko*, to know—to know through. It implies a knowledge that penetrates—a perception of the inside as well as the outside of things. Practically considered, the term means, *know your case—know it thoroughly—know it through and through* before you attempt to treat it. No word could have been chosen to denominate this branch of science which could be more clear, pointed and technical, or have a more imperative force than *diagnosis*.

To gain a clear and comprehensive meaning of the word is to gain a high conception of the importance of the science, and a prompt suggestion of the method of far too many failures.

The most common and plainly discernible symptom of disease is pain. Yet the cases are numerous of disease not attended with pain. I might employ a tautological expression and say that dis-ease—using the word disease in its two senses, its technical and its elementary sense. The technical word disease is the compound of two words—*dis* and *ease*, which mean want of ease, or discomfort. To say therefore that dis-ease or discomfort is the most common expression of disease, would be both true and forcible. Want of ease or discomfort is the negative expression of pain. Increase the discomfort, and pain in a positive form is sensibly manifest.

Pain is so common an attendant of disease, that, in its absence, other manifestations are quite often overlooked, and its presence is often misinterpreted.

This leads me to suggest a caution, not to trust sensation too-

implicity as a guide to diagnosis. Take a simple case of dentalgia. A patient comes in complaining of toothache in one of the inferior bicuspids. He is certain concerning the location of the pain. On examination you find the tooth but slighly decayed and question the possibility of pain arising from it. But should you trust to the sensation experienced, and without further examination dismiss your patient as having only a case needing the operation of filling, you might, in so doing, make a serious mistake. Had you made further examination you probably would have discovered exposure of the pulp of the second or third molar as the source of the pain, and find an explanation of the pain in connection with the bicuspid, in the fact that the dental nerve supplying the molars sends a branch through the mental foramen located just below the root of the second bicuspid, and is distributed outwardly to the lower lip. By inflammatory action in the mental artery the nerve has become constricted at the point where it passes through the outer plate of the maxillary bone and causes this bicuspid pain.

Again, take a case of determining the vitality of the pulp by refrigerants—a drop of water or a piece of ice is placed upon a tooth. The excitement of pain by such a test is not alone sufficient evidence of vitality in the pulp. Should your patient be of decided neuralgic diathesis, cold water could scarcely be tolerated on any of the teeth; even pulpless teeth are sometimes so susceptible to its influence as to deceive both the patient and the operator concerning the character of the sensation experienced.

Again, nervous fear deceives with the apprehension of pain and is attended by all the outward signs and demonstrations of pain, when no physical pain is actually experienced.

Suppose you attempt the test of vitality by drilling into the dentine. In many cases the trembling fear that the instrument *may* suddenly plunge into the pulp chamber produces in the mind of the patient an impression akin to that of actual pain, and pain is reported though it may afterwards be found to have been but the exhibition of fear.

Drilling to test the vitality of a tooth may deceive also in another way—by the manifestation of the pain even though the pulp be entirely wasted.

I know, we are in the habit of attributing all sensation in the teeth to the presence of the pulp. But histology reveals other vital connections with the hard tissue so intimate in their relations to the pulp, that the *dead line* of pulp extinction is scarcely to be traced in the dentine.

It is not uncommon to find the dentine tubuli opening into the canaliculi and lacunæ of the cementum; thus forming a vital connection between the cementum and the nerve plexus that is spread like network over the peripheral of the dentine. If then the pulp has been devitalized without exciting any serious peridental disturbance, vitality may yet remain in the uncalcified portion of the nerve plexus that underlies the enamel, after the pulp chamber and root canals have been entirely vacated.

Sensation on the entrance of the drill is not therefore certain evidence of the presence of a living pulp.

This vital connection of the dentine with the cementum, is an important fact to be remembered in estimating the vital support and longevity of a tooth after its pulp has become extinct.

I desire to call attention to the very critical judgment required in cases like the following: A cavity is prepared in the anterior portion of the mouth, and no suspicion has been aroused of approach to the pulp. The rubber dam has been adjusted and a thorough cleansing of the cavity accomplished, the foil is prepared, and as your patient sees the gold about to enter the tooth he enters his mild protest by the remark, "Doctor it aches."

For a moment the gold cleaves to your tweezers while you muster your etiology for all possible causes of dentalgia, and one by one they are applied to explain the manifestation of pain. Should you conclude that, although you had not before discovered it, the pulp must be nearly or quite exposed and need capping, your operation might be entirely successful while your diagnosis is entirely wrong. And as for the operation of capping it would receive unwarrantable credit.

Should you conclude it to be the wisest to delay the operation a few days for topical treatment, and apply anodynes, escharotics, astringents, etc., the pulp might survive it, and the after operation of filling be painless and every way successful, yet your diagnosis be very wrong.

Should you conclude that to make the operation safe the pulp

must be extirpated before filling, your whole operation might be successful as a dernier resort for the preservation of the tooth, and still your diagnosis be wholly wrong by mistaking the cause of the sensation of pain.

To arrive at a correct diagnosis of the case, consider the changed relations to its normal surroundings. The natural protection of the lips has been removed. The warm influence of the saliva has been excluded by the rubber dam. That protection afforded by the dentine has been removed by the work of excavation, and nothing prevents the air of the room—possibly the air from an open window—from direct contact with the floor of the cavity. Under these abnormal conditions and by this means the temperature of the pulp is suddenly reduced several degrees below its normal temperature, and the sudden vascular contraction thus induced causes pain.

It is evident therefore that this sensation of pain is no evidence of disease in the pulp, and therefore needed no therapeutical treatment. And there being no exposure of the pulp and no near approach to it, the case needs no capping. Much less are there any conditions present that indicate extirpation as a remedy. A rapid filling and restoration of the tooth to its normal environment, restores the normal temperature, relieves the pain, and all is well.

I have said that the diagnosis must precede all rational treatment. It must also accompany treatment to the end—until health and soundness are recovered. Under treatment there are a series of modifications of conditions indicated by changed symptoms. These modications must be observed with the same critical care as were the first developments of the case. In this connection I desire to call attention to the deceptive influence of anodynes, narcotics, and antiseptics.

To obtund nervous sensibility is an immediate relief of pain. So is also a removal of the exciting cause a temporary relief. But neither is certain evidence of remedial effect on the disease.

Many a man has taken copious draughts of whisky to cure the toothache. He may feel the pain less though the disease steadily goes on. With carbolic acid and creosote, one may continue to obtund the sensibility of a tooth till the pulp, being but half alive, will be obtunded to death. The treatment having the effect

to cause a painless death to the pulp, may be interpreted to have restored the pulp to a condition of health—and therefore painless. Of course to fill a tooth under this false diagnosis would be disastrous.

Suppose a patient comes into the office complaining of slight pain in a molar tooth. There is a small opening in the central depression of the crown, and spreading under the enamel, yet not involving any considerable portion of the tooth substance, has never ached till within a day or two, and at no time has the pain been severe, is worse after eating than at any other time, after picking the food from the cavity the pain ceases.

You hastily remove the contents of the cavity—syringe with warm water; apply a pledget of cotton moistened with carbolic acid, and dismiss your patient to call again in one or two days. On his return he reports having experienced no pain since the former treatment. You consider the report favorable and continue the treatment. Sealing up the cavity you dismiss him for two or three days. After this, the pain not having returned, you dismiss your patient for a longer period—not wishing to over medicate—but advise an immediate return to your office on a recurrence of the pain. There is no recurrence of the pain and at the time appointed for the next visit you determine to fill permanently. You are delighted to find the bottom and the lateral walls of the cavity firm and hard, and free from painful sensations on touch of the instrument. There being no peridental inflammation, neither pressure or malleting causes any flinching. The operation is completed and the patient goes on his way—but to return again, complaining of pain worse than he has ever experienced before.

What is the matter? A false diagnosis from the beginning, and self-deception by the antiseptic influence of carbolic acid.

A true diagnosis of the case might be thus stated: The tubuli of the dentine intervening between the cavity of decay and the pulp cavity were vacant, by complete solution of the dental fibrils that have occupied them. The pulp itself was in a state of suppuration and slow decomposition. In the decomposition, gases were formed, filling the vacant portion of the chamber, and being emitted through the open tubuli. When these gases could pass out as rapidly as formed no pain was felt. When the

exit was impeded by foreign substances accumulated in the cavity of decay, the expansive force of the enofined gas created pressure upon the vital portion of the pulp and caused pain. The more intense pain after eating was occasioned by the more complete stopping up of the cavity by compressed food. When the food was picked out, the confined gas by force of expansion passed slowly out through the open tubuli, and relieved the pain by relieving from pressure the living portion of the pulp.

When the therapeutical treatment was resorted to, the cleansing of the cavity gave free egress to confined gas, and whatever solid matter was put in solution by decomposition; and the antiseptic influence of the carbolic acid, arrested so completely the decomposition of the pulp, that whatever gas was formed readily made its escape without producing any reactionary force upon the pulp, and thus the pain was entirely arrested. Mark, I say the *pain*, not the disease, was arrested. The continued treatment simply retarded the disintegreation of the pulp and rendered the process painless.

When the operation of permanently filling was performed, antiseptics could no longer be introduced, decomposition was renewed, and there being no possible escape for the resulting fluids and gases, the pain necessarily became intense.

There are probably no greater failures in diagnosis than are made with regard to the pathological condition of the dental pulp. This delicate organ is so concealed from view and its manifestations of disease so peculiar and obscure, that a correct observation of symptoms is extremely difficult, and great allowance must be made for errors of judgment concerning its pathological state. Experience is a large factor in correcting such errors.

When the pulp of a tooth has become exposed to external influences, a series of pathological conditions in more or less regular succession may be considered inevitable, unless the disease is arrested. Our knowledge of the pathology of the pulp must depend upon our knowledge of the anatomy of the organ and of general pathology in relation to similar structures. The function of the pulp is so limited and so unimportant relative to other vital organs that the functional disturbance under diseae can seldom be made a matter of observation. While on the

other hand, the limited vitality of the pulp, its slight tenacity of life, its tendency to obliteration, all point to structural change of the organ under disease; and this is no doubt the tendency in all cases of exposure.

Before proceeding farther with this branch of my subject, I cannot forbear to express my great surprise that the profession have so generally ignored the necessity of diagnosis as a preliminary step to treatment of an exposed pulp. In the highest representative bodies of the profession as well as in those of lower standing and authority, you may listen to discussions, lengthy and learned, concerning treatment of exposed pulp, and hear almost nothing said of the varying conditions of the pulp induced by the exposure,and needing treatment according to the varying pathological conditions.

You may listen to long essays on "Exposed Pulp," describing treatment, without hearing scarcely a word about any treatment peculiar to this or that condition of the pulp. You may read lengthy articles in the journals all about exposure, without even naming any other abnormal condition than exposure, or even proposing to treat any other condition than exposure. I am glad to notice an exception to this in the last *Dental Cosmos*, in an article by Dr. A. H. Thompson, of Topeka, Kansas.

How are we to intrepret such silence? Do the profession esteem diagnosis of the pulp a matter of no consequence? Is the same treatment adapted to all conditions? Do. the words "exposed pulp" have a meaning so comprehensive as to cover all pathological changes through which the pulp may pass from normality to complete dissolution? The glossary of pathology contains no such form of words as "exposed pulp." The term "exposure" implies no form of disease and recognizes no pathological conditions of the pulp.

The word conveys no other definite idea than a mere mechanical opening and does not necessitate or force upon the mind any idea of pathology. Yet this word has come into general use not to express pathological conditions, but to cover up the worst forms of disease. The word itself caps the climax of all deceit concerning the pulp. It is a mind-capper, a thought-capper, a knowledge-capper. Is it any wonder then, that, led by the mere mechanical idea which the word expresses, the profession

should so generally have adopted the practice of a simple mechanical capping for a simple mechanical opening? Is it any wonder that a mechanical capping should come to be considered the *summun bonum* of pulp therapeutics?

Mechanics could play a brilliant part with anatomy, if pathology could be put under bonds to keep the peace. It could not only cap the opening into the pulp chambers, but could splice the pulp and lengthen out a nerve with gutta percha. But pathology will *not* keep the peace under such circumstances.

How to treat an exposed pulp, has been *the* problem before the dental profession for the last twenty-five years. We have made some progress towards its solution, even great progress. But, as it appears to me, one capital mistake has been made, and that is, a failure to diagnose the case of exposure with regard to the pathological conditions of the pulp which inevitably follow exposure.

An exposed pulp may be found in any one of the following conditions, each of which defines a functional or a structural change, and indicates a treatment successievly modified to adapt the remedy to the condition of the diseased pulp.

However the exposure may be produced, whether suddenly by the excavator, or by the slow process of decay, the first effect is an *irritation of the pulp.* Its normal condition is that of confinement and exclusion from the air and from the fluids of the mouth. By exposure the atmosphere and saliva, both foreign elements, are brought in immediate contact with the pulp. The nerve filaments of that delicate organ are the first to respond in twinges and flashes of pain as the direct result of the irritation.

The irritation continuing, a second condition is induced which we call *inflammation.* This is a response from the vascular system of the pulp. Irritation and nerve excitement have accelerated the flow of blood. This observed fact was, by the old latin authors incorporated into a maxim thus: *ubi irritatio ibi fluxus*—where the irritation is thither flows the blood.

Inflammation, therefore, is characterized by quickened arterial action, increased quantity of blood flowing into the pulp, and consequent distention of the vessels, and heat.

But the susceptibility of the blood vessels to distention is limited. The contractile power of the arteries is diminished

by being overtaxed. The capillary vessels fail at length to pass the whole amount of blood over into the venous system. Hence the blood accumulates in the pulp in greater quantity than is demanded for normal nutrition.

This condition of the pulp is known as *congestion*, and is the third to be named in the progress of the disease.

Trace it still farther and we find that the blood thus accumulated has wasted its vitalizing influence, and become degenerated blood, and must be disposed of. Not being able to pass through the capillaries it bursts their weakened walls and passes to the surface of the pulp as pus. We now have a fourth condition—a *suppurating pulp*.

If perchance this does not happen, and the capillaries are not parted, but distended and disposed to pass the accumulated blood, this superfluous amount of blood may form new and superfluous tissue, thus expanding the pulp and forcing it out into the very opening caused by the decay. This excessive nourishment develops a condition known as *hypertrophy* of the pulp. It is the direct opposite of, and antagonistic to, the condition last named, and the fifth condition possible.

Pursuing this line of progress we find that hypertrophy, which is an excessive development of normal tissue, tends to the development of new tissue of another kind—a *fungus growth* called sometimes *polypus* or *tumefied pulp*. This is the sixth condition in order, although this tendency of the pulp is not very common. I have met with several cases in my practice, in which the abnormalties had adapted the pulp to an open air life free from pain—the excresence filling the entire cavity of decay and overhanging the margins. This tumefied condition is highly vascular and bleeds freely on the slightest touch.

Returning now to the suppurating pulp we find it undergoing a destructive process both of the functional life and of the substance of the pulp. Its cell structure is being broken down. The peripheral cells, which are the working cells, *odontoblasts* as they are called, being destroyed, the closing of the exposure by a deposit of secondary dentine, if not impossible in the nature of the case, is altogether improbable, and the wasting away of the substance of the pulp reduces it to a fraction of its normal size, and a fraction of its normal vitality. It is alive,

with a tendency to death and obliteration. This is an emasculated pulp, a fragmentary pulp, and is the seventh and last of the pathological conditions I have to name.

Now let me ask the thoughtful practitioner, if, in view of the definite and varying pathological conditions which I have named and to which an exposed pulp is subject, is it enough for the purpose of rational treatment, to know simply the fact that the pulp is exposed? Again let me ask, is it in the nature and the therapeutical power of carbolic acid and oxychloride of zinc to cure each one of these seven forms of pulp disease which I have named and restore the pulp to its normal functions? I believe that a negative answer is the only intelligent reply that can be given to these questions.

If so, every case of pulp exposure demands most imperatively a critical diagnosis of pulp disease.

When then I am asked concerning the treatment of exposed pulp, the question is not an intelligent one, and cannot receive an intelligent answer without a thorough diagnosis of the diseased condition of the pulp which shall determine whether it is in a state of irritation, inflammation, congestion, suppuration, hypertrophy, tumefaction or emasculation.

Admitting that such diagnosis is extremely difficult; without it, all treatment is a random effort, and mere guess work. I had intended giving some of the more marked characteristics by which these several conditions may be known. Thus to stimulate and encourage study and observation of the nature of pulp disease. But to avoid wearying you with too great length of my paper, I feel compelled to confine myself to general principles and omit, for the most part, minutiæ.

There is one department of my subject to which I have not yet alluded, and that is "prognosis," which is a judgment of the course of disease with regard to its probable termination. It seems to have been assumed by many that the orthodox treatment of any case of exposed pulp is certain to restore it to health.

Within a few years some have been inclined to doubt the success of their own treatment of many cases, and have narrowed down the list of cases that are of permanent success to the few which exhibit the most favorable symptoms. But the capping

process and the assumed preservation of the life of the pulp have been so commonly made the criterion for judging of man's professional skill and standing, that very few have dared to express their doubts or reveal the modifications of their practice.

Doubting has sprung up from the multiplied and increasing number of failures. But naturally enough, many have accounted for their failures, not from the nature of the case but from some faulty method of applying the treatment. But the more we study the nature of the pulp, the peculiarity of its functions and its relations to surrounding tissues, the more plainly will it appear that failures do arise from the very nature of the case.

Diagnosis of every case of pulp disease with reference to treatment should be made in full recognition of the following facts:

1st. The pulp in its most healthful physiological state tends to obliteration.

2nd. The vitality of the pulp is so feebly maintained in mature teeth that the slightest causes often produce death.

3rd. When diseased, the natural tendency of the pulp to extinction is greatly enhanced.

The first fact just stated is worthy of the most thoughtful consideration in relation to prognosis. In a paper which, by request, I presented before the Odontological Society of New York City, at their meeting in April last, on the "Relations of the Dental Pulp to the other Tooth Tissues," I adduced a large number of illustrative facts drawn from animal physiology, and instituted a line of argument based upon well observed facts in human anatomy and physiology as applied to the genesis and exodus of the teeth, in proof that the pulp, even during the period of its most legitimate performance of function, *tends to obliteration*. Without again offering the proofs, I must refer you to the proceedings of the Odontological Society, published in the *Dental and Oral Science Magazine*, where I have at some length discussed this and other important relations to the dental pulp.

I shall, therefore, in the present paper assume it as a fact, and call your attention to it as all important in diagnosis of pulp disease.

The question now plainly resolves itself into this; with the natural tendency of the pulp to obliteration, how great reliance can be placed on its waning vitality under disease to restore the organ to healthful and permanent performance of function?

This natural tendency exaggerated by disease must be overcome as well as the disease itself. A rational diagnosis of disease of the pulp must therefore include an estimate of the vital force yet remaining in the pulp after having greatly exhausted its function in the formative work of organizing the hard tissue and having exhausted its vitality in combating disease.

A physician does not deem it necessary in every case to consider the disease with reference to prognosis, because he expects to control the prognosis by his remedies. But when the disease and the action of remedies is modified by constitutional idiosyncrasies, peculiar diatheses or heredity, it is all important that prognosis should enter largely into his examination of the case. In diagnosis of disease of the pulp, one all important and ever present fact must be considered and must have its influence in controlling the judgment of every case. And that fact is not an idiosyncrasy, or any peculiarity of one case as differing from another in any manner, but it is a fact having all the force and power of a law of nature. It is a law of nature. The gradual extinction of the pulp as life advances is not the result of disease, but it occurs as a natural process of tooth development; it is the uniform working out of the economy of life with relation to the teeth as organs of mastication.

TRSNSPLANTATION.—Dr. Schoeler presents the history of a case in which, for the first time, the cornea of a dog was transplanted into a human eye successfully. After the insertion of the cornea into its new position, the wound was entirely covered with a flap of conjunctiva. Six weeks later a peritomy was performed, so as to cause the disappearance of this artificial pannus. The result was so far successful that the patient was enabled to recognize the movement of the hand at six inches. Several cases, showing the advantages of the conjunctival flaps in the treatment of wound of the sclerotic, are narrated.—*Medical Record.*

SURGERY OF THE FACE.

BY FRANCIS MASON, F. R. C. S.

[*A Lecture delivered at the Medical Society of London, February, 1878.*]

MR. PRESIDENT AND GENTLEMEN :—Having briefly disposed of the diseases and injuries of the face, I propose, with your permission, in this my concluding lecture, to describe some of the principal deformities that are met with in this region, with their appropriate treatment. I shall pass over such congenital malformations as do not come within the scope of the surgeon's art those I mean that would be generally classified as monstrosities.

In a paper "On the Relation of the Teeth and Mouth to Mental Development," Dr. Langdon Down lays stress on the characteristic features of the lips in congenital idiots. The lips, he says, are usually thick, the thickness being greatly more marked in the lower than in the upper one. In addition to the thickening they are often striated and marked by transverse fissures. They are frequently deficient in muscular power, and the want of muscular action interferes with their prehensile function, and also induces a tendency for the saliva to run over the chin. The mucous membrane is extremely liable to chronic inflammation, and ulceration is induced by the slightest pressure against prominent or uneven teeth. The glands of the mucous membrane of the mouth generally, as well as the salivary glands, are usually hypertrophied. Again, he speaks of certain semi-lunar folds of skin at the inner canthus of the eye—folds, which he believes, are more frequently present in feeble-minded children than in others, and which he describes as epicanthic folds. They are, according to his experience, marks of developmental degeneracy, and should always be looked for in doubtful cases. Then he remarks that the seat of implantation of the ear in idiots is usually placed further back in relation to the head and face than in normal children. The mouth is arched or gothic shaped; the tongue increased in size. It is

rugous, fissured, and its papillæ are enlarged. Again, the angle of the jaw is more obtuse than usual.

Perhaps the commonest observable congenital deformity of the face is harelip. Having written so recently on this subject, I have little to add to what has been already published; but I may be permitted to dwell for a moment on one or two points in connection with this deformity.

1st. Respecting the intermaxillary or premaxillary bones. I think there can be no doubt that when harelip is associated with a fissure of the hard palate, the fissure takes the place of the lateral incisor tooth of one or both sides, as the case may be. In other words, the lateral incisor is usually wanting.

It is extemely rare to find a case of double harelip with no fissure of the palate whatever, but such a case is now under the care of my colleauge, Mr. Croft, at St. Thomas' Hospital.

2nd. The hereditary character of harelip is occasionally very striking. Thus Dr. Buck gives an account of a family in which there was a very remarkable hereditary history: "Mrs. Molineri and her three children (all girls) came under his notice in January, 1871. The mother herself bore the marks of a successful operation for harelip performed in childhood. She had a brother and sister with harelip; and besides the three living children above referred to, she had four others, who had all died in early infancy; three of these had harelip, and the fourth one only was a perfect child. In other words, there were nine instances of the deformity in two generations of a single family."

3rd. I may be permitted to make one or two practical remarks respecting the method of operation. The harelip pin with the twisted suture is very commonly employed to bring the edges together; but, without entirely discarding this method of approximating the parts, I feel sure that the usual interrupted suture of silk may in most cases be employed with great advantage, and I believe, with certain precautions, it is in many instances preferable; but whether the twisted or interrupted suture be used, the success of the operation mainly depends, first, on the soft parts being thoroughly freed from the subjacent bone; secondly, on the edges of the fissures being so pared that a good broad raw surface is left; and thirdly, that the patient be incessantly watched for three or four days by a skilled nurse, who should support the

newly united surfaces by making continuous but gentle pressure on each cheek. I have little confidence in the use of mechanical appliances *after* the operation; for in nursing the child they are apt to shift their place, and often do more harm than good. They are, however, invaluable as aids in bringing the two superior maxillæ together if worn *before* operative procedure is undertaken. Again, strapping is of especial service before the operation, but afterwards it cannot be with safety solely relied on.

Besides the ordinary forms of harelip, fissures of the lips extend in other directions. Thus Mr. Ward describes a case in which the fissures extended into the right cheek; and another more remarkable case is recorded in which a boy was born with a very large mouth. At seventeen years of age his mouth was six and a half inches in diameter, extending from one ear to the other, so that the tongue always hung between the teeth. Langenbeck operated on the lips and brought the parts together. Another remarkable example is reported by M. Guersant, in which the fissure on each side extended towards the eyelids.

The mention of harelip almost necessitates a few words on fissure of the palate, of which there are several varieties. It is, however, extremely rare to meet with a case of fissure of the soft palate with an entire absence of the uvula, but such a case I have had the opportunity of showing you to-night; and on the subject of cleft palate I confess I have little to add, excepting that in closing the hard palate, I usually perform the muco-periosteal or Langenbeck's operation. Dieffenbach's plan of dividing the entire bony palate with a chisel, and which was introduced into this country by the late Sir W. Fergusson, has the disadvantage that it is sometimes accompanied by exfoliation of bone; but this untoward result may to some extent be obviated by boring a few holes with an ordinary brad-awl in the line in which the chisel is to be applied. Whichever operation is selected, the closure of the hard palate is often attended with troublesome hemorrhage, but the bleeding may be instantly arrested by plugging the wounds on each side with dry lint, after which the operation may be completed without difficulty. Severe bleeding of an intermediary or secondary character occasionally, but very rarely, occurs. Such a case has been recently reported by Mr. Marsh.

The chief object of the operations for cleft palate is, of course,

the improvement of the voice. I need not refer to my views on the subject further than to say that a cleft in the soft palate is not a mere rent or slit in the parts, but is an actual deficiency of want of tissue. Hence, after the edges of the soft palate are bound together, the part remains as a tight curtain, stretched between the mouth and posterior nares. The result is that in speaking, the air, instead of passing into the mouth, gains access to the nostril, and thus the peculiar nasal twang is maintained. I therefore venture again to recommend the performance of a very slight operation, an account of which I published in 1869. It should be understood that this procedure is an entirely independent operation, and should be performed only when the surgeon is perfectly satisfied that firm union has taken place. The incisions on each side release the part, and the palate is, so to speak, converted into a huge uvula.

Besides congenital defects of the superior maxillæ and the palate bones, there are cases recorded of a deficiency in other bones about the face. Thus Delpec gives a description of a patient who had a congenital absence of the right nasal and lachrymal bones, the nasal process of the superior maxillary, and of the soft parts.

Again, Dr. Samelson exhibited at the Manchester Medical Society a patient, aged twenty-three, who had a congenital defect of the frontal bone. There was a somewhat thickened integument extending over a cavity produced by the absence of the bone. Within the gap the cerebral pulsation was very plainly visible.

Mr. Gay has favored me with the notes of a case in which there was congenital absence of the nasal bones. The rough sketch I send round will afford some idea of the condition of the parts. And Mr. Bryant, in his work on surgery (vol. i., p. 236) refers to a case of Mr. Poland's, of meningocele, which caused a considerable prominence over the nasal bones.

Dr. Lichtenberg also reports a remarkable instance of a congenital tumor which protruded through the mouth of a newly born babe. The growth overlapped the chin, and rested with its base on the sternum. From the appearance, Dr. Lichtenberg believed the case to be one of polypus, and put on a ligature as tightly as possible, and cut off the tumor. Three or four days

after the patient died of convulsions. At the post mortem examination the pedicle of the tumor was found to perforate the sella turcica, and was there attached to an oval tumor which was connected with the brain. Such a case as this should make us remember that it is not always easy to pronounce a decided opinion as to the exact nature of a congenital tumor; and whilst I am on this subject I may allude to an instance that was under the care of my former colleague, Mr. Arnott, which showed the difficulty of arriving at a correct diagnosis. There was a round sessile swelling, the size of a large walnut, situated in front of the anterior fontanelle, in a child eight months old. The history of the case pointed very decidedly to the tumor being a meningocele. No operative treatment was adopted, but the patient died of broncho-pneumonia; and at the post mortem examination the swelling proved to be a cyst of a dermoid character, and was quite unconnected with the interior of the skull. The mistake (adds Mr. Arnott) in the instance mattered little; but fatal errors have been committed by surgeons mistaking meningocele for simple dermoid cysts, and undertaking their removal.

Again, Mr. Gay tells me he now has under observation a case in which there was a swelling, the size of a small walnut, situated at the front part of the left temporal fossa. The patient was seventeen years of age, and the swelling had become prominent for the last ten years. Mr. Gay believes he had discovered the true nature of the tumor by cutting down, but not into it, for rather severe symptoms followed the operation. No pressure on it, or other efforts to detect the real nature of the swelling, answered before exploration. The tumor was thought to be a meningocele.—*London Lancet.*

EPISTAXIS AND ALVEOLAR HEMORRHAGE.

The *Buffalo Medical* and *Surgical Journal* contains an essay read before the Buffalo Medical Association, by Dr. Bartlett, on the "Treatment of Accidental Hemorrhage." The following extract comprises that portion of the essay which treats of epistaxis and alveolar hemorrhage.

I first of all refer to epistaxis.

Nose-bleed is, perhaps, the most common of all hemorrhages, and often proceeds from trifling causes, especially in those of hemorrhagic diathesis. Nor unfrequently, it is positively alarming from its copiousness and the failure of attempts at suppression. Occurring in the course of certain phlemasiæ, as for instance, typhoid fever; it may decide the case adversely to the patient. It is to a certain extent, perhaps, salutary in some cases, but excessive losses are always detrimental.

The means usually recommended and employed are cold; styptics, as alum, salts of iron, lead, copper; position of head; packing of the nostrils with cotton or other fibrous material, with or without styptic solutions; plugging of the posterior nares by similar materials drawn into place by a flexible catheter or the instrument of Bellocq; external pressure in divers irregular ways; the elevation of hands above the head; and, finally by astringents addressed to the general circulation. In spite of these varied means, death, not unfrequently follows epistaxis, either by sudden collapse or the influence exerted upon the course of existing disease.

The means I have found singly, and combined, to be an effectual remedy for epistaxis is pressure external or internal. The experience of more than twenty years has convinced me that the ordinary forms of styptic treatment—or packing as ordinarily practiced, are wholly unreliable in cases at all severe, or appearing in the course of disease.

In June, 1863, I had charge of a case of typhoid fever occurring in a phthisical young gentleman residing on Seneca Street, near Michigan. The disease was protracted and the patient became exceedingly feeble from diarrhea and loss of digestive power.

Early one morning, I was called to find him bleeding from the nose to a most alarming extent. I used styptics, plugged the anterior nares, and with the assistance of an eminent physician, now deceased, tightly closed the posterior nares—all these proceedings failed to do more than check,—they did not stop the hemorrhage. In certain positions the loss, drop by drop, passed outward, in others inward. General treatment had no perceptible effect, and after 36 hours perseverance, I found my patient rapidly failing. In this dilemma I removed all the packing from the nares, when the slow drop, drop, passed outward. At last by pressure applied to the angular branch of the external carotid, I had the satisfaction of finding the hemorrhage fully controlled. This I accomplished by application of the thumb and finger at the lower border of the Ossa Nasi externally. Temporary removal of pressure was followed by hemorrhage, and to secure continuous pressure, I shaped the jaws of a spring clothes-pin to fit the nose, removing a portion of the wire spring to lessen pressure. This simple tourniquet remained in place and the patient recovered. Satisfied, by this experience, of the doubtful utility of packing in the usual way, I felt quite safe until a case of nasal hemorrhage occurred in a patient about 14 years old, residing on Scott street, near Washington. The lad had suffered previously, and his mother did not feel alarmed until he fainted from loss of blood. Before my arrival he slightly rallied only to sink exhausted by fresh bleeding. He was pulseless, sightless, breathless, and to all appearance dead. I forced some whisky down his throat, and practiced artificial respiration. As he gasped, I passed a sponge tent, intended for other use, into the right nostril from which I supposed the blood had flowed. It soon expanded and filled the nostril posteriorly and anteriorly, completely controlling the hemorrhage. I left the tent in position forty-eight hours; on removal there was no loss of blood, and I had the pleasure of being assured years afterwards that the treatment had been radically successful. Since that date, August, 1863, I have used the sponge tent in all alarming cases of hemorrhage of the nose. My cases number 27, comprising those occurring in typhoid, diphtheria, scarlatina, traumatic injuries and causes not capable of tabulation. I think I may fairly claim originality in this proceeding.

Another form of accidental hemorrhage is that known as

alveolar, following the extraction of teeth. Instances of death are quite frequent from this cause. I recall a case in which I used a treatment somewhat novel. The patient was a soldier discharged for sickness and on his way to friends at the West. He had suffered from acute hepatitis and excessive ptyalism, in which condition a tooth was extracted by a dentist. When seen by me he had bled apparently five or six pints, and the blood was passing in a fine needle-like stream from the inferior maxillary. Every effort to arrest it had been made, apparently, by styptics, etc., and still the hemorrhage went on. Finding plugging the cavity of no avail, I procured a large cork and hollowed it so as to clasp the lower outer edge of the inferior maxillary, just back of the dental foramen, to compress the inferior dental. Pressure was then made by a band carried over the head, a small cork tapered to pass well down upon the bottom of the cavity, the jaws closed so as to make pressure upon it and the band tightened to make pressure upon the dental artery externally. Hemorrhage ceased and did not return. I recommend plugging the cavity left by the removed tooth, with a slender cork, which has first been conveniently spitted upon an ordinary dining fork. This is very convenient for keeping the cork in place, and the patient is advised to keep the jaws firmly compressed.

BURNS AND SCALDS.

THE ALKALINE TREATMET—ITS HISTORY.

BY DR. G. F. WATERS, NO. 8, BEACON ST., BOSTON.

Whilst reading a summary from Mr. Holmes' "Manual of Surgery" on the treatment of burns and scalds, published in the *Boston Journal of Chemistry* for November, 1876, the idea occurred to me that there was something of importance known about burns and scalds, not included in that summary, which

ought to be made public. These are the facts which came to my mind: In 1837, I saw a little sister too young to talk, scalded with a solution of bicarbonate of potassa. A half-pint of the solution flowed over her neck and chest. The water had just been poured from the kettle in an active state of ebullition, and before the kettle could be set down the little girl had done the work. To tear off her clothing was but the work of a moment, and the scalded surface was then covered for a short time with a calico apron. In two minutes she had stopped crying, and, looking into her mother's eyes, began to laugh. My mother thought it hysterical, and expected to see her soon go into convulsions. She made all haste to dress the surface with sweet oil and laudanum, with cotton batting over all, but the surface blistered before she could finish dressing it, the vesicles being quite small and near together. The next morning all signs of a burn were gone, except little white patches of desquamation where the bullæ had been. There seemed to be no soreness, and there was no after trouble. So far as I know, there was at this time no thought of ascribing the wonderful cure to the saleratus in the water; and yet my mother might have had such an idea. A story which she told me at that time, of an old horse wounded in the side and turned out to take his chance of cure without care, would seem to imply as much. This is the story: A potash factory was by the side of the pasture, and the horse would frequently come to a heap of leached ashes and nibble them. One of the workmen, disgusted at the sight of the gaping wound, all alive with the larvæ of flies, dashed a ladle of hot lye into the wound, startling the horse and destroying the parasites, and the horse was in a few days cured of his wound and taste for leached ashes. This is really the first case of alkaline treatment—occurring, as it did, in my mother's girlhood—of which I have heard.

The next case which came under my notice was in 1869. My oldest daughter, then in her fourth year, was accidentally crowded against a hot cooking-stove, by which her arm was burned from wrist to elbow, the embossing of the stove burning in deeply. Soap suds was first applied to the arm and gave relief, and, as soon as it could be prepared, the "linimentum ex aqua calcis" was used to dress it with. The emulsion was made with olive

oil. It was quite bland and soothing. She made no complaint and had quite a quick recovery.

The next case was in 1865. I had opened a large three-case Robert's vulcanizer, hastily. The thermometer, when I began, indicated a temperature of 320 degrees Fahrenheit. Violent ebullition soon cooled down the water to 212 degrees Fahrenheit, but the upper part of the vulcanizer was very much above that temperature. Wishing to cool down my case as soon as possible, I grasped the flange of the vulcanizer, with both hands—using woolen pads in so doing; but, as I started for the sink to empty out the hot water, my left hand slipped its hold and that part of the vulcanizer dropping, brought my right hand into the scalding steam. That the cool air might keep the steam away from it I at once lifted the vulcanizer and at the same time tried to recover the lost hold of the left hand. I succeeded, but in doing so I got about five deci-liters of water, in a violent state of ebullition, on my wrist and into my sleeve. My training in the chemical laboratory had taught me to keep cool in accidents, but, though I kept my muscles under control, I could not keep my arm cool. So, whilst my assistant stood aghast, I sat the vulcanizer down, took off my coat, unbuttoned my sleeve and lifted it up from the arm, which was as red as a boiled lobster. Behind me, and within reach, was a case of drawers, one of which contained a good supply of bicarbonate of soda. As soon as I felt the hot water upon my arm the whole case of my sister's scald came vividly to my mind, and the thought with it that it was the bicarbonate of potassa which saved her. I had no bicarbonate of potassa at hand, but I had soda bicarb., and without a second's hesitation I thrust my right hand into the cool soda and felt a relief; withdrawing it with a handful of soda, I lightly rubbed with it the left arm and wrist wherever burned. I then buttoned my sleeve again, although it was still wet and warm, and took up the vulcanizer and went on with my work; the whole detention was less than two minutes. When my assistant found his mouth he said "you'll be laid up three weeks with that." But it did not give me a moment's uneasiness thereafter. The next case was in 1875, when I burned the inside of my left hand with a

metallic die, the temperature of which was very much above boiling water. The skin was scorched and contracted. I was standing near my sink and at once took up a cake of biborate of soda soap, dipped it in water and applied it to my hand. It gave me relief in less than a minute, and the relief was permanent. When I read the article in the *Journal of Chemistry* all of the above cases came, as I have said, to mind, and I at once thought that there must be reasons for the pain in a burn other than the proximity of the air; and that the philosophy of the cure was in some way connected with the action of the alkalies. Experiments (on my own person) showed me that of all the alkalies bicarbonate of soda was the quickest and best and lime, the slowest and poorest in action, potassa being between the two. Nature places them in their appropriate places in the animal system. Thus, take a cross section of any limb, and we find the bone (lime compound) central; surrounded by muscles (potash compound); and the skin external, with its albumen associated with soda. During the winter of 1876 I made a study of the human saliva as found in the mouths of my patients, on the microscope stage, with polarized light. There I found the lime compounds of a solution to first appear in a crystaline zone, followed by the potash and stronger (acid) soda salts, as chlorides and sulphides, etc., the bircarbonate of soda being the last to put in an appearance, and the whole mass on the slide seeming perfectly dry before a crystal of the bicarbonate of soda was seen. Thus, bicarbonate of soda is shown to be in a fluid condition with a minimum amount of water, and bicarbonate and phosphate of lime to require a maximum amount. Here the microscope explains the philosophy of the position of the alkalis and alkaloids in the living body, as well as why bicarbonate of soda is the proper alkali to apply to the skin for any purpose. As we investigate we always find albumen in association with bicarbonate of soda, or soda in some form, showing them free yet constant lovers.

In the winter of 1870 the late Dr. N. C. Keep recommended me to use for my eyes, which were suffering from overwork, the vapor of *bi-sulphide of carbon*. To apply it by means of an eye-wash bottle, holding the bottle in the hand so as to warm it, and thus to vaporize the bi sulphide. In using it, I found that as soon

as vapor began to form, there was a sharp, pricking sensation in the surface of the sclerotic coat exposed to its action, and that this surface soon began to show signs of inflammation, the small blood vessels enlarging and carrying red blood. A natural desire to know the philosophy of its action led to a course of experiments, in which it was conclusively shown that the pricking was caused by the vapor entering the minute pores, arresting and severing the natural course of the flow of the contents, thus pressing upon the adjacent nerves, and continued pressure, causing continued back action, allowed the red blood disks to glide into the enlarged vessels. Applied to the skin, I found that it, and also chloroform and ether (sulph.), would produce all of the phenomena of a scald, even to vesication, if continued long enough.

Cold applied to the skin may produce the same phenomena. The volatile hydro carbons produce their effects by pressure applied to the mouths of the pores, penetrating them and causing them to dilate and *press upon the contiguous nerves*, thus producing pain. Cold crystallizes the contents of the pores, and thus obstructing them produces its effects. Heat contracts the albumen, hardens, stiffens, and thus closes the pores and produces pressure upon the nerves. The application of bicarbonate of soda gives its quick relief by dissolving or softening the albumen in or around the pores, and thus allowing the restrained contents to escape, and relieve the pressure. That the pain is due to pressure is shown, also, by the fact that position is all important in giving relief. Thus, a man came to me who had burned his hand with melted sulphur. He had scraped off the sulphur and washed with soap, and came with his hand in a wet towel suffering intensely. By urging I got him to stand still whilst I placed a half dozen grains of soda bicarbonate in his open palm; a drop of water added made a stiff paste, which at once removed the pain? Holding his hand up to the light, and gazing at it with a look of astonishment, he exclaimed: "By golly, I don't see how it does that!" But, as he turned to leave my office and took hold of the door-knob to open it, he suddenly turned, exclaiming: "It has all come back again." I explained to him my theory of pressure, and directed him to so pose his limb as to let the blood gravitate towards the heart. He had no more pain. Many other cases have come to me of a like nature showing the same fact

and the May number of the *Boston Jounrnal of Chemistry* says we have met with only one unfavorable report concerning the new remedy. Dr. R. P. Oglesby states the case of his child in *The Doctor*. It seems that the child's hand was scalded by the steam from a kettle. The hand was treated by "placing it in a solution for nearly ten minutes." Now the position of the limb in this case was such that not only could no relief come, but even the blood-vessels would be dilated so as to make a pressure that would not quickly be relieved upon the limb being properly posed; but, brought into proper position for relief by gravitation, and having the contracting power of cold applied, it would have ceased to give pain in less then ten minutes, and I do not see why ten seconds would not have sufficed (see *Journal*, p. 30.)

I arrived at the conclusion that pressure was the cause of pain about the last of January, 1877. I now began a search through medical books and among friends to see if I had been working on old ground. I could find nothing that even hinted at my conclusions. It did not occur to me to ask Dr. White, although I frequently saw him at the meetings of the Boston Society of Natural History. In April I met Dr. William F. Channing, of Providence, and gave him, quite briefly, the results of my studies on the treatment of burns and scalds. He at once said that it was all new to him, and advised me to publish or make known the results of my investigations, as they were of too much importance to be allowed to repose in the possession of one or of a dozen persons. So I resolved to publish as soon as an opportune moment arrived, which soon came at a meeting, in Salem, of the Massachusetts Dental Society. My essay was unwritten and was delivered in the Institute building, on the 8th of June, 1877. Before eight o'clock on the morning of the 9th of June, a woman in this city read the report of the essay as printed in the *Boston Daily Advertiser* and in half an hour had a chance to try the cure. She was taking lemon pies from the oven; a pie slipped from her hands; she sprang to save it, hit the edge of the plate in such a way that the pie was turned over upon her hands, hot from the oven, bottom up; she turned it on to the table, saved her pie, then quickly washing off the sticky stuff applied the bicarbonate of soda, which, as her

good fortune ruled, was at hand on the table. It gave her immediate relief. She told a friend, who came to me with the story, that she could see the fire leave. No unpleasant results followed. Many such cases are constantly coming to my knowledge. I will close with a case of scalding by soap which occurred in Concord, Mass:

Mr. Cyrus Hapgood (then twenty years old—now sixty), was at work in a soap factory making hard soap, using barilla with leached-ashes lye. A sudden increase of heat caused the soap to boil over. He had on a coarse cotton shirt, open in front, with a button six or eight inches down from the neck. The top of the kettle was about breast high, and when the soap came over, a quart or more flowed into his bosom. He says the pain was awful, but he could not stop; he just leaned forward for a few moments and held his shirt off until it cooled a little, and then he went on with his work saving the soap, which was now done. At night he took off his shirt and washed up; there was no soreness of the skin where the soap had been, and he suffered nothing from the soap scald after it got cool. This was a year or so subsequent to my sister's scald. Mr. H. gave me the history of his case Sunday, May 12, 1878.

My treatment is to apply to the burned surface bicarbonate of soda; if it is a wet surface, in fine powder; but if it is a dry burn, use a paste of bicarbonate of soda and water, or a strong solution of the bicarbonate of soda in water and apply to the burned surface. This relieves sun-burns, as well as burns from hot coals, melted sulphur, hot iron, steam, etc.

N. B.—Always dispose the burned surface so that the blood can gravitate toward the heart if possible, as otherwise a continuous pain may be felt, due to the dilation of the blood-vessels from the weight of the contained blood.

If bicarbonate of soda is not at hand, bicarbonate of potash is the next best; biborate of soda does well, but is not often found handy. Then the emulsion of lime-water with oils makes a good dressing where the skin is broken. But vaseline is preferable, as there is no odor from it and it is quite as bland.—*Boston Daily Ad.*

COOKERY AND EDUCATION.

It was a suggestive remark of Count Rumford "that the number of inhabitants who may be supported in any country upon its internal produce depends about as much upon the state of the art of cookery as upon that of agriculture; but, if cookery be of so much importance, it ought certainly to be studied with the greatest care. Cookery and agriculture are arts of civilized nations; savages understand neither of them."

There is a great deal of important truth wrapped up in this passage, of vital interest to society in general and to individual welfare, but which it has taken a hundred years to appreciate so fully that any considerable number of people can begin to coöperate in reducing it to practice. But, if what Rumford said is true, if the scale of population as well as the comfort and health of the people depends to such a degree upon the art of cookery, what are all the issues of politics over which men are fighting with such desperation in comparison with the systematic improvement of the culinary art? How greatly the public weal is dependent upon the condition of agriculture, begins now to be widely understood, and since the time of Rumford g progress has been made in its scientific study through the es lishment of special schools and colleges for the purpose. Agricultural education is now a recognized branch of popular culture which is destined to be greatly developed and extended in the future. The next great step must be to do the same thing for the art of cookery; and the friends of genuine social improvement may congratulate themselves that the progress of education is beginning to take effect upon this important department of domestic life. Cooking schools are springing up in many places in this country and in England, and the English are taking the lead in organizing them as a part of their national and common school system.

Of the importance, the imperative necessity of this movement, there cannot be the slightest question. Our kitchens, as is perfectly notorious, are the fortified intrenchments of ignorance, prejudice, irrational habits, rule-of thumb, and mental vacuity, and the consequence is that the Americans are liable to the reproach of suffering beyond any other people from wasteful, unpalatable, unhealthful and monotonous cookery. Considering our resources, and the vaunted education and intelligence of American women, this reproach is just. Our kitchens are, in

fact, almost abandoned to the control of low Irish, stupid negroes, and raw servile menials that pour in upon us from various foreign countries. And, what is worse, there is a general acquiescence in this state of things, as if it were something fated, and relief from it hopeless and impossible. We profess to believe in the potency of education, and are applying it to all other interests and industries excepting only that fundamental art of the preparation and use of food to sustain life which involves more of economy, enjoyment, health, spirits, and the power of effective labor, than any other subject that is formally studied in the schools. We abound in female seminaries and female colleges, and high schools, and normals, supported by burdensome taxes, in which everything under heaven is studied except that practical art which is a daily and vital necessity in all the households of the land.

Acquiescence in this state of things as something permanent and irremediable is no longer possible. If, as Rumford says, cookery is an art of civilized nations, it must improve with the advance of civilization. It is undoubtedly the most backward of all arts, and various causes conspire to its continued neglect. But, whatever the difficulties to be overcome, the time has arrived when the advance of intelligence and the spirit of improvement must invade that last stronghold of traditional stupidity, the kitchen. Nor are the difficulties of doing this by any means so great as is so commonly supposed; they will vanish as soon as the task of alleviation and amendment is earnestly undertaken. As soon as thought and cultivation are brought to bear upon the domestic operations of the kitchen, they will be elevated in the common respect, and a most formidable impediment will thus be removed. American women have been driven out of the kitchen because all its associations are degrading, and they demand education as a preparation for all those other activities to which education leads. When the art of cookery becomes a matter of intelligent study, so that its practice will no longer be a badge of debasement and humiliation, occupation will be sought and honored in this field as elsewhere. The establishment of cooking schools is, therefore, in the direct line of our domestic amelioration and emancipation. They are already, as we have said, established, and, considering the embarrassments of an initial movement of this kind, are in most successful operation. Though at present narrow in their scope, they develop and widen so as to afford a training in the broader field of general household activity; but we are well content with what has been already gained. The South Kensington Cooking-School, in London, is a normal school for training teachers to go out and take charge of other schools in different parts of the country. How successful this institution has been may be in-

ferred from the fact that it has already given us the best practical cook-book that we now have.—*Popular Science Monthly.*

There is no class of persons that are, or ought to be, more directly interested in the subject of food, than are the readers of this Journal. That food should contain the elements necessary for the building up of *all* the tissues of the body, is universally conceded. Yet the prevalent system for the preparation and cooking of our chief article of breadstuffs, brings to our table food that is sadly deficient in some of the most important requisites.

The most notable deficiency is the scant supply of those substances that are demanded for the proper sustenance of the osseous and nervous tissues. Every intelligent dentist recognizes the importance of an abundant supply of the food elements chiefly concerned in the formation of the teeth. This demand does not cease with the eruption of the teeth, in early life; but continues until full maturity is attained, and perhaps to a still later period.

The subject of education in the science as well as in the art of cooking is, therefore, one that should receive the earnest attention of every member of the dental profession.—Editor.

A CASE OF CHLOROFORM-POISONING.

BY J. A. LARRABEE, M. D.

A young German woman, aged twenty, in good health and sound constitution, swallowed an unknown quantity of chloroform, between the hours of 2 and 3 P. M. Having a short time previous stated that she desired to take a nap no inquiry was made for her until 4:30 P. M., at which time she was observed to be sleeping, and was left to finish her nap. At 5 P. M. an attempt was made to arouse her, which, on account of the peculiar odor smelt in the room and the deep stupor, awakened suspicion, and a neighboring physician was at once summoned.

Attempts at emesis brought up strong fumes of chloroform, and a strong current of electricity was applied through the pneumogastric and diaphragm. I saw the patient at 7 P. M. The above treatment had been steadily carried out and well directed by the doctor, notwithstanding which I found her quite pulseless and fast sinking. A feeble impulse with a single sound could be heard when the ear was placed over the heart. No apex beat or second sound, and the right ventricle, largely distended, was making abortive attempts at contraction. Nitrate of amyl was placed in the nostrils and forced respiration commenced. Not the slightest observable improvement followed. A sudden change to pallor gave rise to the announcement that she was gone. I now proposed to inject one-tenth grain of digitaline into the cellular tissue over the scorbiculus cordis, and did so; in twenty minutes from this time the heart's sounds were audible, and in thirty minutes my friend counted the radial pulse. This improvement was noticed for an hour, at which time, the circulation again failing, I then injected one-tenth grain more, and left to get supper, Dr. K., remaining. On my return there was not only a good, fair pulse, but the respiration was more thoracic and regular. In order to stimulate the respiratory centers, which evidently were not up with the circulation, I gave one tenth grain atropia hypodermically, and in another hour the urine was withdrawn, a little more than a pint in quantity. At 11 P. M. respiration and pulse both good; dilated pupil; fixed dryness of mouth.

I met Dr. K. at the case at eight next morning. Nothing further had been done during the night except to induce her to swallow some nourishment, which, on account of the denuded mucous membrane of the throat, was quite impossible. She was quite rational, and evidently chagrined at the result of her foolishness. She admitted to have swallowed the whole quantity purchased, one ounce of pure chloroform. I have since learned that her recovery was rapid, and not delayed by gastric or œsophageal inflammation, as I feared it would be. A day or two after I saw her she had, I suppose, a hysterical spell of choking. —*Louisville Medical News.*

Artificial Dentistry.

REPAIRING BROKEN VULCANITE.

Dr. T. F. Howard, of Geneseo, N. Y., thus describes his method of mending broken vulcanite plates: "Bring the broken pieces together, and wax them in their position. Fill the palatal portion with plaster. Remove the wax, and, with the engine and a wheel burr, run along the whole length of the break or crack; then sandpaper the polished surface slightly, so that the trace of a lead pencil can be seen; then mark out such places, extending across the broken part, on the palatal portion and labial border, as you desire to have banded and supported with new rubber. Now with the engine and a burr-wheel go over the ground marked out with a pencil; this gives an outline of the section to be cut out. Then, with a course round burr, these places are cut almost through, leaving but a thin shell of the old material. Undercuts and dovetails are to be obtained at such places in these cutouts as are strongest, in order to secure the new material.

In small partial cases this work can only be done after the parts are secured in plaster, and put up in the flask.

Now that cavities for the reception of the new rubber and bands are all prepared, they should be filled with wax a little flush, so as to allow for finishing down nicely.

A piece of gold should be selected for the cutout on the labial border, about one-fourth of an inch longer than is required to fill the cavity in length, and about an eighth of an inch at each end should be bent at a right angle, giving the form of a bracket. This should be pressed into the wax, and occupy the same position you desire it to have in the rubber; a conical roll of wax should join this, and extend directly down to the cutting edge of the teeth. One end of this will be at the surface of the plaster in one section, and form the avenue through which the rubber is forced to the place we wish to mend. The projecting ends of the gold band are held by the plaster.

Oil over the whole of this section; adjust the flask rim; fill with plaster; separate the section; remove what wax you can conveniently with the wax-knife, and put the case in water, and have it boil. Now, with a syringe, (I use a common rubber syringe, kept for this purpose alone), the wax is forced out of every undercut and depression, leaving it perfectly clean. The case is then removed from the water, and such pieces of rolled gold-plate or platina are cut as will drop into the cavities easily on the palatal surface. These are spurred or roughened, that the rubber may take firm hold. Then, warm a piece of rubber, make it thin; stretch it across the cavity, and press the band well into the cutout, then cover with another piece. When the places are all filled up, the case is ready to vulcanize.

When the case is removed from the vulcanizer, it is finished off in the usual manner. Occasionally the gold will be seen at different points when finished, but it only serves to show how securely the case has been repaired. It secures to the denture strength that cannot be had in any other way.

Partial plates can be strengthened by this method, and an isolated tooth can be supported and made as strong as though it were one of a section of teeth, by simply cutting a strip of gold and bending it with plyers to conform to the general shape of the cast; imbed it in rubber at its proper place, and vulcanize it in that position.

I have had occasion to strengthen and repair celluloid plates in about the same manner.

The surfaces to be united should be coated with celluloid dissolved in spirits of camphor.

By this method of strengthening rubber and celluloid plates, we are enabled to make a success of many cases that would otherwise be weak and doubtful."—*Condensed from the Dental Office and Laboratory.*

Journalistic.

The *Dental and Oral Science Magazine* for August, contains a paper by Dr. J. Edwin Line, in which he contends for the importance of following the line of cleavage of enamel, in the preparation of cavities. He asserts that where this line is not followed crumbling of the margins of the cavity is liable to occur except where the enamel is thick and well formed.

The line of cleavage is coincident with that of the enamel rods, and in general may be said to radiate from a point near the center of the pulp chamber. Hence the right-angular walls of certain cavities cross the line of cleavage diagonally, and for that reason Dr. L. claims the margins often crumble, however well the operation of filling may have been done. This crumbling of the margin of the enamel produces a narrow V shaped groove that causes leakage. If the line of cleavage had been followed in the preparation of such a cavity, the enamel portion of the wall must necessarily have a flaring shape. If the enamel is thin, the undercut, if any is provided, must be made in the dentine. When the enamel is thick, a slight undercut or groove may be made in the enamel. "To sum up, bevel the walls of the cavity with the line of cleavage of the enamel, and, if possible, to the full thickness of that tissue.

In the *Cosmos* for August is an article on separating teeth, by Dr. Theodore T. Chupein, in which he advises the use of cone-shaped corundum points, in opening spaces between the upper incisor teeth, cutting only from behind so as not to change the forms of their anterior faces. For the molar and bicuspid teeth he recommends the use of small corundum cylinders, one-half inch long, having cone-shaped points, working as before, only from the lingual sides. These spaces are permanent openings, being maintained by the contact of the labio-approximal corners which are untouched.

In same No. Dr. W. H. Trueman invites attention to "a very minute tooth-mirror, rather smaller in circumference than a green pea, which he had had made for the more careful exa

nation of pulpless teeth. From its size he was enabled to pass it within the cavity of decay in molars, and by its aid, with suitable instruments, to more effectually remove all debris from the roots."

The *Register* comes to us filled with interesting matter. In an article devoted to bleaching teeth the editor arrives at the conclusion that the most effective method of improving the appearance of stained teeth, is to first cut away as much of the dentine as can be done safely and then treat with hypochlorite of lime. Care is required in its use lest by a too frequent application, the tooth might be injured by the action of the hypochlorous acid which is set free during the bleaching process.

The *St. Louis Medical and Surgical Journal* in its report of the transactions of the St. Louis Medical Society, recites an operation by Dr. Hodgen for the cure of neuralgia by excision of the inferior dental nerve.

"A cut was made inside the mouth to the base of the coronoid process, boring through to the canal and getting part of the nerve at that point; then I dissected on the inside of the lip and passed a blunt hook around the nerve as it passes out of the mental foramen and pulled it out; the patient has not suffered from neuralgia since."

Another operation in which a portion of the infra-orbital nerve was removed, is described as follows: "An opening was made in the skin of the face just below the orbit—horizontally—about three-fouths of an inch in length, down to the bone. I then passed a short blunt hook along the upper surface of the superior maxillary bone to the spheno maxillary fissure; hooked up the nerve and clipped it off with a scissors; then depressing the skin I passed the hook through the same cut to the infra-orbital foramen and drew the nerve out of the canal."

"THE POPULAR SCIENCE MONTHLY" for October will be issued about September 20th. This number will open with an illustrated popular article by Prof. J. S. Newbury, of Columbia College, on "The Geological History of New York Island and Harbor," and will also contain articles by Bain, Huxley, Spencer, Kirkwood, Brooks, and other eminent home and foreign writers.

D. APPLETON & Co., Publishers.

Editorial.

THE METRIC SYSTEM.

The use of the metric system is authorized by law throughout the civilized world. In several European States the system is obligatory, and hence the only one in use.

The term metric is derived from the Greek word "metron," a measure. The system comprises the Meter, the Liter, and the Gram. The Meter is the unit of length, the Liter is the unit of capacity, and the Gram is the unit of weight.

To these words are added six prefixes, as follows: Deci, Centi, Milli; Deca, Hecto, Kilo. The first three are Latin, and *decrease* the value. The last three are Greek, and *increase* the value. The value of the Latin prefixes are: Deci, a tenth; Centi, a hundredth; Milli, a thousandth. Example: Deci-meter, one-tenth of a meter, etc.

The value of the Greek prefixes are: Deca, ten; Hecto, hundred; Kilo, thousand. Example: Hecto-liter, one hundred liters, etc.

The Meter is the ten-millionth part of the distance on the surface of the earth from the Equator to the North Pole, ascertained by actual measurement, and is equal to 39.37 English inches, or a little more than a yard. This is the standard of linear measure.

The Liter is the measure of capacity, being a cubic decimeter (one-tenth of a meter), and is a fraction more than our wine quart.

The Gram (Gramme in French,) is the standard of weight. It is the weight of a cubic centimeter (one hundredth of a meter,) of distilled water at a temperature of 40° C, or 39.2° Fahr., and is equal to about fifteen and a half grains troy, a decigram (one-tenth of a gram,) being about a grain and a half, and a centigram one-tenth as much. The Kilogram (1,000 Grams,) is equal to about two and a quarter pounds avoirdupois. Fifty Kilo-

grams are often roughly taken as an hundred weight (112 pounds,) and 1,000 Kilograms as a long ton (2,240 pounds,) the deficiency being not great.

A teaspoonful represents on an average about five Grams, and a tablespoonful about twenty Grams.

One great advantage possessed by the metric system is, that like our money system, it is expressed in decimals. The many conveniences resulting from the use of the system seem to indicate its early adoption.

DENTINE.

Dentine, both primary and secondary, is unquestionably formed through the agency of the odontoblasts, and in no other way. When, therefore, any portion of the odontoblastic layer has been destroyed, no formation of dentine can take place over the territory covered by the lesion, unless the odontoblasts are first reproduced. Are they ever reproduced? Does the tooth-pulp ever set up such a reparatory or reproductive process? In our opinion, no! Yet the question may be regarded as undetermined, for the reason that the testimony is all of a negative character. No one has ever shown that they *are* reproduced; but neither has any one ever shown that they are *not*. The burden of proof however, rests with the affirmative, and until it is demonstrated that odontoblasts are reproduced, after they have been pathologically or mechanically destroyed, those who question their reproduction have very much the best of the argument.

DIPHTHERITIC POISON.

Prof. E. N. Chhapman of Brooklyn, claims that alcohol is as purely and essentially a specific for the diphtheritic poison as quinine is for that of intermittent fever. He insists upon the early administration of this remedy—as soon as the character of the lesion is ascertained—in large quantities and frequently. repeated.

IN the United States there is one doctor to every 600 inhabitants. In Canada one to every 1,193 inhabitants. In France one to every 1,672 inhabitants. In Austro-Hungary one to every 2,500, and in Germany one to every 3,000.

DENTAL ASSOCIATION OF MARYLAND AND DISTRICT OF COLUMBIA.

The annual meeting of the Dental Association of Maryland and District of Columbia, will be held in Washington City, commencing Tuesday, October 8th, 1878, at 11 A.M. Officers—President, B. F. Coy, Maryland; Vice President, J. Curtiss Smithe, District of Columbia; Recording Secretary, M. W. Foster, Maryland; Reporting Secretary, F. F. Drew, Maryland; Treasurer, H. B. Noble, District of Columbia. Executive Committee—J. B. Ten Eyck, District of Columbia; E. P. Keech, Maryland; W. W. Evans, District of Columbia.

A CARD.

[For the MISSOURI DENTAL JOURNAL.]

It has been maliciously circulated amongst members of the profession by one or two character wreckers that I had sold my dental diploma. I feel compelled to thus deny so base an imputation, which has no foundation in truth whatever.

P. T. SMITH.

BURLINGTON, Iowa, Sept. 13, 1878.

We cheerfully give place to the above denial. A charge of so serious a character as the one alluded to by Dr. Smith should surely not be allowed to go unchallenged.

"DARLING, LISTEN TO MY STORY," a beautiful new song and chorus by Harry Percy, arranged for piano or organ; easy to play or sing. Published by Sudden & Bates, Savannah, Ga. Price 40 cents.

Books Received.

The Advantages and Accidents of Artificial Anæsthesia. By Laurence Turnbull, M. D. Published by Lindsay & Blakiston, Phila. 1878.

A comprehensive treatise on the properties and uses of the various anæsthetics, both general and local, that have been employed in Surgery during the last thirty years. The book is full of knowledge, useful and necessary to the dentist, and should be in the hands of every practitioner whether he employs anæsthetics or not. Everything that is known concerning Artificial Anæsthesia up to the present time is comprised in this volume.

Involuntary Action of the Nervous System. A paper read before the American Dental Convention, Aug., 1877, by John J. Caldwell M. D., Baltimore.

Treatment of the Genito-Urinary Organs by the use of Electricity, Damiana, etc., by the same author.

The White Mountain Echo. Containing an account of the weekly meeting of the Hay Fever Council at Bethlehem, N. H.

Proceedings of the Wisconsin State Dental Society—*Seventh Annual Session*, held at Madison, July, 9—20—11, 1878.

Officers for ensuing year; President—J. M. Barker, of Elkhorn; First Vice-President—C. E. Babcock, of Milwaukee; Second Vice-Presdent—T. B. Fletcher, of Portage; Secretary—M. T. Moore, of Lacrosse; Treasurer—L. C. Stewart, of Waupun.

President Barker appointed the following Committees:

Executive—W. H. Chilson, Appleton; A. Solliday, Watertown; B. G. Marcklein, Milwaukee.

Membership—Wm. Decker, Oshkosh; R. S. Wells, Sparta; E. F. ong, Black River Falls.

Ethics—J. W. Cornelius, Madison; W. T. Hurd, Boscobel; J. S. Reynolds, Monroe.

Publication—M. T. Moore, LaCrosse, A. H. Amos, Racine; E. Churchill, Columbus.

Finance—E. N. Clark, Beloit; R. W. Hurd, Madison; W. H. Ford, Beaver Dam.

THE MISSOURI

DENTAL JOURNAL,

A MONTHLY RECORD OF DENTAL SCIENCE AND ART.

VOL. X.——OCTOBER, 1878.——No. 10.

FANCY *vs.* FACT.

THE BASIS OF SCIENTIFIC PROGRESS.

BY J. N. FARRAR, M. D., D. D. S.

Read before the Brooklyn Dental Society, N. Y.

MR. PRESIDENT, GENTLEMEN:—The theme of minutely recording operations, is by no means a new one. It has been treated by many, and yet we find that, in fact, minute records of dental operations, though they are the fundamental requisites in scientific research, are not common.

But it does not require great discernment for a professional man to see that the various wide differencies in the sayings and doings of a large portion, not only of our profession but of other professions, must be ascribed to different conceptions of what is the real truth. Facts are too often lost sight of, and theory, or rather, hypothesis, is made the base or foundation of arguments, which are often uttered with an astounding degree of assumption, as if they were really established facts.

Discussions, essays, books—aye, libraries—are written every

year, based upon such premises. They not only mislead the young, but "muddle" the minds of the unthinking old.

The world is full of chaff and tares, and it is not to be wondered at, that, amidst such accumulations of Ptolemaic waste matter, the few grains of wheat can only be discovered by the more diligent searchers after truth.

Presuming upon the ignorance of others, the Ptolemaic theory has too often served as the sounding horn of one's own kingdom.

Even Socrates showed a crack of this sort, down through the very center of his character, in his claims to illumination by special supernatural inspiration.

Galen's doctrines abounded in assumptions of knowledge, and of fundamental principles, and consisted almost wholly of pure imaginings, with scarcely enough of truth to hold them together; yet they stood as authority for 1,200 years and more, during the more ignorant ages, and managed to survive (though more feebly) in the later centuries, from that very fact alone; yet, under the Baconic system of thought—of facts before guesswork—they finally crumbled under the "slow wheels of the gods," as the tardy, but sure, progress of truth was ground out.

Although the people of the past often bitterly opposed the investigation of truth, and claimed that the great age of a theory was the highest evidence of its truth, yet this old and weak method has lost ground, and the test of age is not now believed in.

The time-honored wonders so glorified in the Iliad and the Odyssey, the Ionian gods of Homer, and the Doric monsters of Hesiod, have vanished from the belief of man, as have many other equally absurd notions of the past. And to whom is to be ascribed this opening of the eyes of the world to truth? To lovers of tradition, or to lovers of the sciences? To lovers of mere acquiescence and conformity, or to lovers of hard, toilsome and conscientious investigation, who have recorded facts as they have been discovered, but who have been bitterly opposed and fought against by babbling theorists, over every inch of new ground gained for the last 3,000 years?

It is through the efforts of these unassuming, hard-working men that the science of medicine has been able to escape from the fetters of priestcraft and superstition.

We no longer see, except among barbarians, the physician acting as a magician, no longer does the hexameters from Iliad, hang around the neck as an amulet to allay the pain of gout; nor a verse of the Lamentations hang as a locket piece to charm away rheumatism.

What has brought about this great change from myths taught through the oracles of temples? Was it the fruit of those people who, as Dean Swift says, draw upon their imaginations for facts; or was it knowledge founded upon tested experimental truths, minute and accurate examinations, and the records of such ascertained facts forming the basis of general conclusions.

No one of the earlier scientists had clearer ideas of the necessity of such a basis than Aristotle. Means unlimited, and the whole then known world at his command, bringing to his dissecting tables animals from all lands, opened to him a window through which flowed floods of light. Not content with a knowledge of other animals; the human body, for the first time, was permitted to lie under his scalpel, and from that day medical science has slowly but surely advanced in spite of opposition from church and state, and advanced, too, purely by the indisputable, impregnable knowledge derived from proven facts, and from the Baconic method of reasoning.

Exact records of facts lead to exact reasoning, and exact reasoning undermines hypothetical errors.

To obtain the highest benefit from recorded observations, it is of the utmost importance that they should be accurately made. Many valuable facts are rendered worthless by such a lack of precision and want of clearness in detail. Do you ask what have statistics done for us? Look at our Smithsonian reports. See our government maps of ocean and air currents and numerous other accumulations of information for the benefit of commerce. Examine our geological reports, and our geographical surveys! How was this accomplished except through an enormous number of carefully recorded observations afterwards tabulated?

Study the coast and ocean surveys, and the reports of the national observatory, of the American Philosophical Society, and the works of hundreds of other scientific bodies. See what "Old Probability" has accomplished.

Witness the various scientific expeditions sent out by the government, to obtain more recorded observations! It was this same spirit that sent forth seven expeditions for observations of the last transit of Venus, all of the results of which were recorded as observed, with great care and at great expense.

Was it not statistics of the variations in the movements of the planet Uranus which enabled Leverier to foretell the existence and the position of an unknown new one.

Was it not the careful system of accurately recording observations, after tedious experiments, which has led to the astounding revelations of spectral analysis.

Astronomy, chemistry, physiology, philosophy, psychology and numerous other sciences owe their present degree of development to the untiring zeal and enthusiasm of those who have passed their lives in the laborious task of minutely recording one truth after another as they become known to them.

Every year traditional guesswork, superstition and sublime nonsense are more and more giving way to the simple unvarnished truth, and sooner or later there will be a generally recognized feeling that the world owes more to men who are lovers of the truth, for the sake of truth and its influences, than to any other class.

The higher intellects of ancient periods were equal to any now living, in points of language, poetry and art; yet they were sadly deficient in knowledge of nature, and of the laws governing matter.

Where mystery existed they were content to accept it as a truthful heirloom from their ancestors, and were not inclined to prove the degree of its real merits by experiment and research. But, at the present day, matter and the laws which govern it are better understood.

Truth is never at variance with itself, though, often, it may, at first appear so, if we are to judge from the assertions of some, who assume to be, but who, in fact are, only partially scientific, and also from erroneous conceptions to be ascribed to ignorance upon the part of others, *who fail to discriminate between what real scientists say are* FACTS, *and what are given by them as* HYPOTHESIS.

Experimentally proven facts, correct observations, recorded, tabulated and correlated, form the basis of progress, and have

tended to the material elevation of all the sciences to their present grand position.

Honesty in records of this sort is all important. Distorted stories of observations, bigotry, or a willful desire to deceive in order to sustain some hypothetical notion, are stumbling-blocks that have done vast mischief in retarding the progress of science. Without honest records of facts, no science can be said to have a solid, tangible basis. Indeed, how otherwise are we to arrive at laws?

Go back over the field of history and we will find dentistry grew out of the *business* (not science) of medicine. We will find that medicine was divided into specialties 300 years ago, and that the department of the teeth is recorded as one of the specialties. By a minute examination and analysis of history, however, it is quite evident that it not only included the calling of the barber, but also what little was then known of general surgery, which was probably little else than cupping, bleeding and the bandaging of wounds. Surgery, therefore, is a specialty distinct in itself, and may be considered as not the independent offshoot of medicine, but as the smaller twin child of the barber, and the sister of its then more important child, dentistry.

It is, however, evident that medicine was then but a trifle more than a bundle of inconsistent "moonshines" and magical nonsense, and that dentristry was also largely made up of the same method of treatment by signs and charms.

I have collated and examined a large number of these, and among them I have found that the paw from the right leg of a rat, hung from a string about the neck of a person, was said to have been a sure cure for toothache on the left side of the mouth, and *vice versa* for the opposite side.

To drink from a skull taken from a grave yard, to take a tooth from a skull and hang it about the neck, to apply the dead tooth to the aching tooth, to carry a double nut in the pocket, to put the parings of finger and toe nails in a piece of paper or in a leaf and burn them, and many other singular absurdities, were said to have been a cure for toothache.

By way of comparison of times, I might refer to the age of the first recorded forceps made of lead and deposited by Eriosistratus (B. C. 300) in the temple at Delphi, a period when no man

no matter how prominent, had courage and confidence enough in his own skill to recommend the extraction of a tooth unless it happened to be very loose, but preferred to "shake it" a little and leave it, or to apply to it the actual cautery, or lotions of hot oil, or narcotics and the like, to relieve the pain.

I might refer to the early efforts to preserve teeth by filling them with galbanam, lead, plugs of iron, etc. I might describe a set of instruments which I saw dug out of the ruins of Pompeii, or speak of the earliest efforts at capping exposed pulps with lead, etc., or the earlier use of the mallet and bow-string drill, but time will not permit.

Why is it that our art was almost at a stand-still from the days of Herodotus for 2,500 years, and that it has become an established science within the last fifty years?

What, unless it be investigation and thought, has brought it from a confused, uncertain calling, to its present liberal, vigorous and commanding position? A specialty which, for rapidity of growth, bids fair to walk, ere long, into the halls of its original mother-science, and graciously supply to her the lacking element which she pretends she has not as yet, needed, but the leaving out of which makes M.-D.-ism only a part of "medicine" proper, by just that part (dentistry) which would furnish the missing complement.

The time will come, as surely as the sun rises and sets, when the scientific dentist, by his own knowledge, will gravitate, not by invitation or permission from them, or by nonsensical "whereas" resolutions declaring ourselves specialists of M.-D.-ism, but by his own right as a member of the healing body, into any medical college or society. Already the medical schools begin to see and feel, and, indeed, are taking on the chairs in order to supply and fill out the proper curriculum of medical instruction.

College education, however, is not everything. It is but the framework of the house. It remains for us, by careful study, by close observation and masterly workmanlike skill, to complete and adorn the edifice, before we shall attain unto ourselves our highest possibilities; and there is no better road to this than by carefully recording our experience in order to assist the memory in forming conclusions.

For the best good of both dentist and patient, it is not enough to keep merely an accurate financial record of operations. It should cover the pathological and the physiological conditions also.

It is a mistake to suppose that this requires much time. Symbols may be used which mean volumes in a nutshell.

Mischief is often done to the younger portion of the profession by those members who, from memory, fill our ears and pages with verbose accounts of their successes, but who never speak of failures, because they "have none."

They would, if they spoke the truth from a knowledge gained by a study of carefully tabulated recorded observations, speak more guardedly and understandingly, and be less positive in manner.

Conclusions based on memory must always be very uncertain, but conclusions arrived at from a study of a long series of *accurate* records of "the ups and downs" of cases, are worth something.

Facts are stubborn things. Men of facts are dreaded by speculators. When a dentist, from tabulated cases covering five or more years, shows the exact per cent of permanent cures of alveolar abscess, for instance; and a certain per cent of the rest reopened in six, twelve, eighteen, twenty-four or thirty-six months; he finds by comparison, that certain circumstances are common to each class of cases, arising from the health of the patient, condition of climate, *or the degree of the degeneracy of the teeth or sockets involved.* He will begin to see the true basis of possibilities, and will be better able to give a correct prognosis.

He may have had some vague ideas of the chances of success before he kept a pathological record, but now he may feel positive, and, upon careful review and comparison of his cases, he can demonstrate to a fraction the true per cent of the various classes of results, and arrive at a knowledge of their causes, by reason of so many recorded facts.

Without accurate records no definite law of average can be obtained. Tabulated facts are everything to the student of science, and to none more so than the dentist.

Everyone who utters remarks in regard to his efforts in our

calling, wishes to be believed and appreciated; yet, as in all scientific societies, we find that not all those who speak with the most volubility and assurance, are set down as authority by those best qualified to judge.

Dr. S. D. Gross says, it requires as much genius to discriminate between the wheat and chaff in medical literature (meaning the monthly and quarterly reports), as it does to diagnosticate disease. Can we not assert that this remark may too often be justly applied to the literature of some of the specialties of medicine?

There is another aspect of the collection of facts, which lies under the control of societies, and which is of very great importance in offering opportunities that cannot easily be gained by individual enterprise. I speak now of collections called libraries and museums, which being the repository of multitudes of observers, offer possibilities of great value.

The value of such masses of accumulated treasure, can be well shown by reference to a valuble paper written by Dr. R. B. Winder, of Baltimore, Md., entitled, "The Teeth of some of the Lower Races," delivered before the Maryland and District of Columbia Society, wherein he conclusively shows that one of the most potent causes of degeneration of teeth lies in the crossing of types and races.

Every dental society should have, not only a library containing every book and paper of value which it is possible to obtain, but should take especial pains to preserve all of its own. these being of more value than mere minutes of transactions. Above all, it should have a well-regulated place for its collection of teeth, bones, charts, diagrams, statistics, etc. In truth, there is no official department in our societies more important than that of the librarian, which, in connection with that of the secretary, may be made to furnish material of incalculable value, from which data, important strides may be made in advancing the status of our science.

INFLAMMATION.

BY WM. H. ATKINSON, M. D., D. D. S., NEW YORK.

(*Read before the American Dental Association, Aug. 8, 1878.*)

The gradual growth to higher and better interpretations of the phenomena of inflammation, as displayed in the works of John Hunter, Virchow, Remak, Billroth, C. O. Weber, von Recklinghausen, Conheim and Stricker, not to mention many others, are proofs of the want of complete satisfaction with which each has looked upon the labors of his predecessor and co-workers, as well as upon his own efforts.

Till this day it is impossible for the best observers to designate the point at which physiological activity becomes pathological. It is at least an entertainable proposition that some of the normal operations attendant upon the ripening of ova and spermatozoids are properly classifiable as inflammatory activities.

Histological research has shown the "corpus luteum" to be composed of scar tissue, of a like character with scars resulting from traumatic and inflammatory lesions. Excess of blood plasm in any locality is liable to be converted into embryonal corpuscles or mucous globules, as the indifferent basis from which normal and abnormal products arise, according as the environment tends to lead to one or the other. Simple hyperplasia tends to increase of the normal tissues. When the blood tracts are obstructed, and the press of the current great; stasis, exudation and retrogressive molecular changes take charge of the exuded blood plasm, and convert it into the products of the inflammatory process, which this retrogressive metamorphosis constitutes.

Late histological discoveries strongly indicate that nerve currents and blood currents are necessary conditions to allow inflammation of any territory. All those territories therefore that are not supplied with blood circulation and nerve currents, if unaided by adjoining currents, are incapable of inflammation and of repairing their wounds when traumatically induced. When

the neural and vascular currents are coëtanous and unobstructed, it is doubtful if any mere acceleration could result in the inflammatory process, but when the heart's action is too great to exactly balance the tonicity of the capillaries supplied by the nerve currents, obstructions are readily induced in the tortuous channels of the capillary system.

To prevent the inevitable advent of inflammation under such circumstances, the obstructions must be removed, and the simultaneousness of nerve currents and blood currents be regained. The simplest method of accomplishing this desirable end will be to call the part into vigorous exercise by voluntary or involuntary effort of the subject, or by "massage," or the manipulation of another person. The only reason why all inflammations might not thus be successfully treated depends upon our inability to recognize the departure from health at this early stage, and to get at the locality.

Swelling, redness, heat and pain have universally been grouped together as the definition of the inflammatory process. Not one has put on record even an approach to legitimate, clear and satisfactory statement of the precise difference between normal nutrient function, and its derangement called inflammation.

Let us examine the process of conversion of pabulum (protoplasm) into the elements of tissue, and learn if we may, that pleasure and pain, health and disease, are qualities or modes, and quantities or measures of functional activities that vanish into each other by disturbing and restoring the balances of regular molecular changes. To comprehend these we must cognize the existence of atoms of which the molecules are composed; and to understand the manner of the coming together of the atoms to construct the molecule, we must take into consideration the static and dynamic aspects of the atoms, no less than the awakening and engagement of the definite measures of energy that effect the combinations. Why? and how? the molecules move, are the two questions the exact replies to which shall reveal to us the complete explanation of all functional movements, and declare how they are produced and maintained or destroyed in functioning bodies.

Pain is the result of obstructed sensory nerve current; *swelling* supervenes upon obstructed vascular current; *heat* is result-

ant upon obstructions in the neural and vascular channels by which the mechanical movements of the masses of nerve blood and vascular blood (through impact against the points of obstruction) become changed into molecular movements which we cognize as *heat*. These three, viz: pain, swelling and heat are the only essential factors or necessary concomitants in the process of inflammation. The redness that has heretofore been made an equal factor, is a mere incident; as is proved by the fact that some swellings are white.

What are we to understand by quality or mode, and quantity or measure of function? And how are we to differentiate these predominant aspects of the complex presence we call function of mind and function of body? The function of mind consists of seriated arrestations and releases of the tensions of consciousness, or the power of perception. The functions of body are also seriated successions of arrest and release of tentions of combinations and separations of molecular and atomic bodies, through which the energy operates to produce molecular, granular, corpuscular, tissual, organic and systemic forms of function in their various manifestations.

Late works on chemistry assert that heat is given out or produced by combinations of atoms, and is taken up or quenched by separations of atoms. Works on physics tell us that "heat is a mode of motion," and that "mechanical motion, upon being arrested, is converted into molecular motion, which is heat." How then are we to account for the heat set free upon the admixture of sulphuric acid and water? How does the friction produce the heat so largely by the mere rushing of the molecules of water among the molecules of acid?

The partially engaged, unsatisfied or sleeping bonds of affinity belonging to the atoms in the molecules of water and acid are in a state to be easily aroused into active motion by an impact of current within the sphere of influence, be it direct or oblique, simple or manifold in its advent. We understand the diffusion of water molecules and acid molecules to result from the desire to attain equi-distance from each other in the mass of fluid; and the rush to acquire that tension effects the awakening of the sleeping bonds of energy, which being set in motion, manifest the intense measure of heat always attending this experiment.

The difference between this process of disengagement of heat and that form attendant upon the inflammatory process in animal bodies, consists in the greater complications of engagements and disengagements of bonds of affinity in the molecular mass in which these changes occur; and the greater freedom of the fluid in the vessel of the chemist, as compared to the confinement of molecular mass in the tissual interspaces of animal organisms. There is also a larger number of elements entering into the molecular mass which is the basis of animal forms of metamorphosis, than in the mass composing the vegetable or mineral examples of molecular aggregations. Hence the increased opportunity for the display of greater varieties of molecular changes that split up and minify the thermal and other currents possible to this limited territory.

There is such a thing as having the receptacle of molecular mass so packed with molecules as to preclude any motion among them. This has been proven by the stoppage of fermentative action by the pressure of a given number of atmospheres. Take the example of a fermentable substance placed in an air-tight transparent vessel, exhaust the air by the air pump, and then inject into the receptacle a quantity of yeast taken from the tub,fresh and active. At first bubbles of carbon-di-oxide (carbonic acid gas) will break and rapidly disperse into the vacuum above the yeast, and there being no free oxygen present to support the fermentation, molecular change ceases to appear. Now admit pure oxygen in a small quantity, and then fermentation is again set up with increasing activity, in the ratio of the quantity of oxygen supplied, up to a given measure. So soon as the tension or pressure of the incoming current of oxygen shall interfere with the freedom of the oxygen molecules in the space above the yeast, the activity of the fermentative change gradually lessens by degrees and finally ceases altogether. When the compression of the oxygen is great enough to arrest the motion of oxygen molecules, they assume a static condition, preventing further changes between the oxygen and the hydro-carbons of of the yeast. The yeast in the vessel is now in the condition of a "pop-bottle," or a bottle of "mineral water," fully charged with carbon-di-oxide. All that is requisite to re-establish the fermentative activity is to take off the pressure from the gas

above the yeast in the vessel by giving it vent, so that the molecules of the oxygen may be free to move among each other again, and the attraction between the oygen and the carbohydrates of the yeast mass is at once set vigorously at work, generating molecules of alcohol and carbon-di-oxide out of the already existing albumen, glucose or diastase in it.

The alternate combinations and separation of atoms to construct the varieties of molecules in the mineral, vegetable and animal primates of bodies, is repeated and amplified, magnified and minified, by the necessities of the types of the individual presence in the various crystals, cells and corpuscles that are the characteristics of the three kingdoms known to exist as planetary presentments. A serial order of appearance and disappearance (or coming from without and passing beyond the range of our senuous perception) pertains to the origination, growth and decline of every example of individual body or class of bodies, be they mineral, vegetable or animal. The chaotification of these gives the foundation from which all human functional capabilities originate; so to understand all the activities possible to human bodies, we must become acquainted with the activities of the whole universe of which man is the epitome.

"The whole is equal to all its parts" is an aphorism in the study of inflammation as true as it is in mathemathics, astronomy and physics. The combustion of hydrogen and carbon with oxygen is well known to produce *heat*. Friction also produces heat to the degrée of ignition of combustible substances. Are we not then justified in assuming that the heat of fever and inflammation is also the product of combustion and friction? And does not this indicate that whatever prevents or arrests combustion will also arrest fever and the inflammation upon which it depends? The difference between fever and abscess is the difference between the combustion in a charcoal pit and in an open fire. The first extracts the hydrogen from the combustible substance, and leaves the particles of carbon in their undisturbed position in the charcoal or coke; the second oxidizes the carbon and hydrogen, converting them into carbon-di-oxide and water, both of which conspire to change the mineral constitutents of the wood or coal into the salts of which their ashes are composed.

If we desire to understand just what fever and inflammation

are, we must comprehend the process of combustion. Combustion is the undoing of the work of the sun which constructs mineral, vegetable, and animal tissues. How does this occur? Simply by the influx of an energy that enables the oxygen to disrupt the bonds of affinity which "clamp" that atoms in the molecules; and the formation of other molecules by the use of these "clamps" in a different order of engagement of bonds. * * * * * * * * Multivalent atoms are those which have many bonds engaged. We may conceive that these placed in the "center," or "skeleton," or "nucleus" of the molecule around which the atoms having few (2 or 3) bonds engaged, are distributed in a variety of ways as its flesh. This variation of the "skeleton" and "flesh" of the molecule is the measure of the differentiation among proximate principles. Slow oxidation of moist organic substances, especially those containing nitrogen, gradually consumes without sensible elevation of temperature. This has been called "eremacausis." (or burning by slow degrees.) Fermentation and putrefaction are both examples of oxidation also, but with sensible elevation of temperature.

Fermentation is distinguished by giving off no offensive gases and by producing useful compounds. Putrefaction is characterized by the exhalation of offensive and deleterious gases. * * * * * * * * * * * *

By this play of affinities, under the direction of the demands of the types of all forms of molecules composing human protoplasm, we have the elaboration of all the proximate principles belonging to the tissues of the human body, embryonal and adult, of a healthy or diseased character. Just how it is that the changes of position of molecules effect difference in the proximate principles of protagon, neurine, myeline, mucine, olein, margarin, chlosterine, cerebrin, lecethin, and a host of others (insoluble, real and hypothetical bodies, nevertheless veritable radicals of the deciduous and permanent tissues of the body) is not just yet demonstrable without great labor with expensive apparatus.

But we do know and can demonstrate that tensile strength belongs to fluids as well as solids (if not to gases also.) Bubbles on pure water prove the tensile strength of H^2O to be a fact which is more easily displayed by adding soap or other viscous

substance to the water, after which bubbles of large size and great strength may be formed, which retain their shape long enough to permit elaborate inspection. Another proof of the tensile force of water may be shown by pouring it from a perforated vessel on a smooth pool, when many spherules will be seen to roll over the face of the placid sheet for sometime before melting into its body. It is said a stratum of air intervenes between the drops and the pool—but what enables each drop to maintain its sphericity if it be not the tensile strength of the water?

The rushing of the molecules of protoplasm under the stress of the inflammatory process has many degrees of rapidity, hence the variety of the so-called products of this process. It may be affirmed that the first degree results in *pus*—a simple, inoffensive body of dead blood, fluid and corpuscular. The second degree is *sanies*—an offensive, decomposing mass of dead blood, evolving sulphuretted hydrogen. The third degree is *ichor*—a yet further disintegration of blood, mixed with disolved and rotten tissues, soft and hard. All that follows in this disgusting recapitulation (of demoniac possession) is the complete subversion of physiological dominion by chemical control of the elements of flesh and bone. * * * * * *

How do we subdue fire? First, by cutting off the supply of fuel; second, by quenching the flames. How is this last best accomplished? Not by water, unless it be sufficiently abundant to flood the whole body of the combustible on fire, but by enveloping the whole mass in a sheet of carbon-di-oxide or any fluid or vapor having no affinity for oxygen, or into which oxygen does not enter as a constituent. Where the fire is well kindled in an obscure building or a part of a structure, it may be wise to isolate that locality and allow the fire to burn out. Just so in local inflammations in territories that can be cut off, preventing contamination of the whole system, it will be wise to ligate or compress the channels of neural and blood supply, until by thus establishing physiological rest, the morbific form of metamorphosis is arrested. Afterward normal nutrition may be depended upon to spontaneously take charge of the territory upon the re-entrance of nerve and blood supply.

Paronychia ("run round") which is an acute inflammation, has often been aborted by persistently plunging the finger into

lye of wood ashes at the boiling point, dipping it in and out at intervals of a few seconds, until the nerve currents and blood currents were so controlled as to discontinue the pain and swelling.

Whenever this method is vigorously and persistently pursued a rapid cure is attained. Even that terribly painful periosteal inflammation called felon, may be aborted, or cut short, by tightly bandaging the finger or thumb. To be sure some pain may follow this method, but it is better to pursue this course, to bridge the period, even though no anæsthetic be used, than to let it run its own course to full suppuration. The safest anæsthetic to use in such cases is ice or ice and salt, to produce numbness of the part until the retrogressive metamorphosis may be controlled. Evaporating lotions of various substances are worthy of trial, one of the best of which is common ether (falsely called sulphuric ether). Rhigoline is also efficient. * * * *

Delpletion by diaphoresis, catharsis, or phlebotomy coupled with nauseants pushed to the accomplishment of the purpose (viz: arrest of inflammation) are methods within the reach of all, and absolutely harmless in the hands of ordinary intelligent patients and practitioners. Bandaging answers a valuable purpose in our efforts to produce physiological rest of inflamed territories. Strips of sheet rubber, judiciously applied, are excellent means to drive back the excess of blood in the extremities. In cases of bruises, or loss of tone of the capillaries from any privation of nerve currents inducing sugillation, such as the petechia (or flea-bite) of low forms of fever, the application of a succession of layers of contractile colodion is an admirable means of removing the blood from these extravasated spots and from the congested capillaries. Eruptions of all sorts that appear as pimples if left to themselves, may be successfully treated by the use of collodion applied in the manner indicated, and faithfully renewed whenever it cracks, until the danger to the face, neck and exposed portions of the skin, is past.

With these principles and remedies, and methods of applying them, coupled with a little common sense and entire control of the patient, no one is justified in allowing inflammations to run their natural course, as is the almost universal practice among general and special surgeons.—*Chicago Med. Jour. and Examiner.*

THE EPITHELIA AND SOME OF THEIR DERIVATIVES, ESPECIALLY THE DENTAL GERMS.

BY M. S. DEAN, CHICAGO.

[The writer, in a few prefatory remarks, stated that dentists have no right to call themselves professional men, nor to rank dentistry among the learned professions, unless they understand, besides the details of general practice, the fundamental principles upon which their specialty is based; and that the minute anatomy of the structures with which the teeth are most intimately connected, and from which they emanate, should most certainly be carefully studied, as well as the dental organs themselves. In order that what would follow this essay (on the origin and development of the teeth) might be more easily comprehended, it would be necessary to refresh the memory, and, if need be, to increase our knowledge regarding the epithelial elements, which are the important factors in these phenomena.

In this essay, the writer stated, he had endeavored to collect and arrange the most recently discovered facts relating to the subject treated of, and to present them in a concise and simple form; and hence he claimed very little originality in what he had to offer.

The authors whose works he had studied and compared, and upon which his knowledge is principally based were: Legros and Magitot, Stricker, Waldeyer, Tilbury, Fox, Von Recklinghausen, Eberth, Klein, Wagner, Neumann, Piffard, Duhring, Rindfleisch, Biesiadecki, Billroth, Kuess, Beale, and Frey, besides the usual medical text books. From these works he had been able to learn the views of many other distinguished authors whom it is not necessary to name here.

He remarked that if the hearer would give close attention to the reading of this paper he would be astonished to find how easily the origin and development of the teeth (which he would afterwards attempt to explain verbally,) would be comprehended.

Drawing of sections of the Epidermis, showing the strata of cells, their forms, relations and changes, were briefly described, and the essayist read as follows:]

Mr. President, Ladies and Gentlemen and Brethren of the Profession:—While I shall make the origin of the epithelia my

starting point, I shall go over the ground hurriedly until these elements are found in near relation to the developing dental organs.

The human organism is first represented by a single cell, and then by an epithelium. Modern histological research has proven that "the first layer of the blastoderm is of an epithelial nature," though it was long believed that the first organ that appeared in the embryo was the nervous system. (Kuess.) This layer becomes the first organic membrane that distinguishes the individual, and is called the germ membrane, or the blastodermic membrane. It is soon divided into three "layers" or "folds" which have received different names by different authors, but which are generally known as the "external," "internal," and "intermediate" layers. From these three germinal layers, or folds, originate all the tissues that compose the organism.

But I shall confine this paper to a partial description of the first of these three layers, the external—the first layer of the blastoderm—the corneous—or germinal layer, as it is variously called.

From this "embryonal stratum," the epithelia of the external surface are derived, and according to Frey, the cells of this layer take part in the construction of the brain and spinal cord, together with the higher organs of sense. The internal coat of the veins, arteries and lymphatics, is composed of a single layer of epithelium, (Eberth, Von Recklinghausen, Kuess) and the capillaries and smaller veins are formed entirely of delicate flattened epithelial cells, (Eberth). In short, the epithelia that grow *outwardly* (Rindfleisch) clothe the entire surface of the organism, integument and mucous membranes in uninterrupted connection; while the epithelia that grow *inwardly* fill up the cavities hollowed out in the parenchyma of the body, and are called the glandular cells, or the glandular epithelium. Both of these systems are produced from the same embryonal foundation, and are a direct continuation and involution of the superficial epithelium; the only difference consisting in the *direction* of their growth. For instance, the glands are formed from cellular shoots that emanate from the lower surface of the epithelial germinal layer, *i. e.*, the lower layer of the stratum malpighii," which penetrate branchingly inwards, in order finally to become

hollow from the free surface up to a certain depth. This growth takes place (Rindfleisch) by division of the existing epithelial cells which is repeated again and again. In the formation of the hair follicle a similar process takes place.

But I cannot dwell upon the various structures that are formed by the epithelia, the various functions they perform, nor the multiplicity of forms they assume: you are already, it is presumed, acquainted with the importance of this corneous, or exterminal germinal layer, and, in general, with its productions.

The epithelium of the oral mucous membranes, from which the teeth (enamel organs) directly originate will require more particular attention.

While Koelliker, Magitot and others have demonstrated the epithelial origin of the enamel organ, it was generally conceded that Huxley was the first to definitely announce this fact, although the literature upon this subject has pointed more or less significantly to this origin of the enamel organ, for more than a century. Hence we see the necessity of familiarizing ourselves with the epithelia, in order to comprehend the origin and growth of these organs, of which we claim to possess a special degree of knowledge.

In the wonderfully accurate (for the age in which it was written) and almost inspired work, upon the development of the teeth, by Jourdain, published in 1765, he says: "After what I have said concerning the early formation of the teeth, it will be seen that I regard the dental cord as a placenta which carries the nutrition (sue) to the body which is formed," and Oudet, as early as 1822, asserted that the teeth were dependent upon the "tegumentary system," and that they were the analogues of the hair, nails, hoofs, etc.*

These, and other authorities that might be cited, show that the conclusion arrived at by Huxley might be naturally drawn from facts already known, though they were more explicitly stated by this latter author.

You are aware that the mucous membrane from which the teeth originate, is a direct continuation of the outer skin, and

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*See page 9, extrait d' un memoire lu a l'academie royale. July 1st, 1822, by J. E. Oudet.

that the anatomical description of one will essentially apply to the other.*

In coarser anatomy, the skin and mucous membrane are described as consisting of two layers: the epidermic or cuticle, and the dermis, cutis vera, or corneum.

But, since the days of Malpighi, the founder of microscopical anatomy,† the skin and mucous membrane have been regarded by closer anatomists as being constituted of three layers—that is, the epidermis was found to be separable, and its external layer was called the *stratum corneum*, while the lower layer took the name of its discoverer, and was called the *stratum malpighii*.

This latter layer, however, is designated by several other terms, viz: rete mucosum, corpus mucosum, mucous layer, etc.

Lately, however, the epidermis has been further subdivided by some histologists who have given special study to these structures.

Prof. Piffard, in his recent work on dermatology, divides the epidermis into three distinct layers, viz.: the stratum corneum, stratum lucidem, and the rete malphighii. According to this writer, the first and last layers named are separated by a pretty distinct line of demarkation, which consists of a thin transparent layer of cells differing from both those in the corneous layer and those in the rete malphighii. This layer was noticed and previously described by a histologist by the name of Oehl, and also, more recently, by Langerhans and Schoern, two German anatomists. However, in the many works written by eminent observers on this point, none of them, as far as I can learn, regard the epidermis as composed of more than two layers, the living and the non-living epithelium.

If it will not seem presumptuous in me to offer an opinion upon this point, I will state briefly my reasons for believing this "stratum lucidem" to be an abnormal or pathological production.

I find many of the noted histologists—if not all of them who

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* For a minute description of the oral mucous membrane see Klein, in Stricker's manual of Histology.

† Marcello Malpighi (1628-1694) and Anton Van Leeuwenhoek (1632-1723) are generally looked upon as the fathers of microscopical anatomy.—*Frey.*

have made the skin a special study—have occasionally noticed the presence of certain cells in the rete malpighii, which differed markedly in size, form and transparency from the true epithelial cells. These cells are said to resemble the connective tissue cells, and by many authors they are considered the wandering connective-tissue cells. [You are probably aware that Von Recklinghausen discovered that some of these cells are *attached*, while others are *free wandering* cells, or amœboid cells.]

These latter elements are derived from the corium or true skin, and are sometimes found partly in this and partly in the malpighian layer; and cells of like appearance are found more or less frequently in different parts of the latter layer.

These are established facts, and show that the lower layer of the epidermis may be invaded by numbers of cells from the adjacent corium.

The appearance of these wandering cells, as described by Biesiadecki, Frey, Rindfleisch and others, is quite different from that of the true epithelial cells, and may be readily recognized by the lustre of their protoplasm, their small size and greater length.

To my mind, these are evidently the cells that constitute the so-called "stratum lucidem;" and they are also the same cells which are mentioned by Frey, as the lymphoid cells which have escaped from the blood-vessels, and which are distinguished by their "brilliant borders," etc.

That white-blood corpuscles, lymphoid cells and connective tissue cells (which may be considered essentially the same), do migrate into the malpighian layer of the epidermis, there can be no doubt. This is a fact concerning which there is no dispute among histologists. Now, there is another fact which I wish you to connect with the one above stated, and that is, that when the epidermis is irritated by disease, a host of these migratory cells rush into the malpighian layer; but they must necessarily be arrested in their career outward when they come in contact with the impervious barrier which is formed by the stratum corneum.

Upon this point, we learn from Biesiadecki, that the number of these cells is augmented in the irritated skin, and that they are sparingly found when it is in a healthy condition. And

Billroth says: "Innumerable wandering cells infiltrate inflamed tissues immediately after they have been inflamed." Apropos to this subject—Rindfleisch alludes to some interesting observations made by Biesiadecki and Pagenstecher, in which these histologists found, after slight superficial inflammation of the skin, wandering cells in all the youthful strata of the epidermis—*i. e.*, in the malpighian layer.

The experiments of Cohnheim are still further evidence upon this point. He introduced fine anilin blue into the lymphatic sac in the back of a frog, and, on irritating the cornea with a caustic, found numbers of these wandering cells colored with this substance collected at the cauterized point, and hence concluded, at an irritated point, white-blood corpuscles wander from the vessels into these tissues. Although I have at hand an unlimited amount of testimony from the highest histological authorities, showing that the cells possessing the same characteristic appearance as those composing the so-called stratum lucidem, may and do emigrate into the malpighian layer of the epidermis; and also that the numbers of these cells are increased when this layer is irritated by disease, I am confidant that I should only weary your patience by adding further evidence upon this point.

Now, suppose the epidermis, on being irritated by disease, should become peopled by a host of these emigrant cells, what would be the natural result? On entering the lower strata of the rete, their course is toward the outer surface; they glide between the soft and yielding cells of this layer until they are interrupted by the stratum corneum, where they would congregate in sufficient numbers (in some instances) to form a pretty distinct lucid line of demarkation *between* the two layers of the epidermis, and this might constitute the stratum lucidem of Piffard, Oehl, and the two German authors before-named.

The theory advanced by these authors is weakened and rendered more improbable from the fact that such histologists as Biesiadecki, Neumann, Rindfleisch, Frey, Von Recklinghausen, and a host of others that might be named, have overlooked this so-called stratum lucidem; and what strengthens the theory I have advanced in regard to the transparent line observed by these authors, and renders it more probable, is the fact that Pif-

fard admits that the specimens from which his observations were made, were taken from portions of the skin that were more or less diseased.*

In view of these facts, I think we may safely conclude that when the transparent line appears between the two layers of epidermis, it results from an abnormal collection of wandering cells.

The prevailing opinion is, then, that the epidermis is separable into two, and only two, layers—the corneous and malpighian, and that both of these strata are composed of epithelial cells, viz.: the young cells, the adult cells, the aged cells, and the dead cells.

The cells composing the stratum corneum, in their infancy, belonged to the lower layer of the stratum malpighii; in their youth, to the more external stratum known as the prickle, spinous, ridged or imbricated cells and, in the middle life, belonged to the polygonal cells which lie still nearer the external surface; and in old age, to the elongated, flattened layers of cells in which the nuclei have nearly disappeared, and which in death, occupy the most external or corneous stratum.

The lower stratum of epithelial cells, (the infant cells) stand vertically upon the corium, and are called the columnar, cylindrical, or prismatic cells, and are said to be destitute of cell-wall. In the embryo, according to Henle, they often appear like a stratum of protoplasm regularly studded with nuclei. Their nuclei are large and ovoid.

The next layer of cells, (the youthful), have grown larger; and, besides their "imbricated" appearance, are surrounded by a thin cell-wall, periplast (Huxley), or formed material (Beale). The cells above these assume larger proportions, and a more polygonal form, and represent cells in middle life. The cell-wall (or periplast) has increased in thickness, while the nucleus has diminished in size. The cells still external to these are the aged cells, and the nearer they approach to the stratum corneum, the

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* Piffard says: "My attention was first particularly attracted to this line of separation * * * in some sections of a leprous stump which had been stained in carmine, etc. * * * This appearance I have met several times, with more or less distinctness, in sections of prepuce near chancres."

larger will be the amount of "formed material" that surrounds the nucleus, and the smaller will be the nucleus, until only a trace of it is visible—or until it entirely disappears, when it enters the corneous stratum, and becomes a lifeless protecting covering for the living cells that grow up beneath. They have gradually become flattened epithelial scales which are so strongly glued together that—to use the figure of Prof. Kuess—they are as "impervious as India rubber."

Both of these layers of epithelium are destitute of vessels, at least none have been discovered in these tissues, and until lately they were supposed to be destitute of nerves.

To Langerhans, it would seem, according to Neumann, belongs the credit of discovering in the malpighian layer, non-medullated nerve fibers. His experiments were verified by Podcopaew, who saw nerve fibers between the cells of the rete mucosum in the skin of a rabbit, and proved their connection with the network in the corium.

The epithelium is regenerated from the cells that stand vertically upon the corium—at least this seems to be the general opinion of physiologists, though we have some high authorities that do not fully assent to this view.

According to Ernest Wagner in the healing of wounds, "most surgeons hold fast to the double origin of the epithelium; partly from the normal epithelium of the borders of wounds and partly from the uppermost granulation cells."

Rindfleisch inclines to the opinion that the connective-tissue cells, or the wandering cells (which we have already discussed in this paper) may become, by a kind of infection, when in contact with the epithelium, true epithelial cells; though in describing the origin of the gland, he says: "its growth takes place by a division of the existing epithelial cells, which is repeated again and again."

According to this author, Burkhardt was the first to designate the uppermost layer of connective tissue as the matrix of the epithelial cells.

It would seem that Rindfleisch believes that the epithelial cells may not only arise from their kind, but that embryonal formative cells may become epithelial cells; yet only when they come in contact with such.

Piffard and Schroen believe that each layer of the epidermis regenerates its kind. And yet the weight of authority seems to be with Waldeyer, Thiersch and a host of others, which may be summed up in the words of Billroth, who says: "In the whole subsequent course of development, a derivative of one germ layer never develops a tissue that was originally formed from another; in other words, if the division of the cellular embryonal plan has advanced to three germ-layers, there are no more wholly indifferent cells, but all newly-formed cells, developed from previous ones, can only develop to tissues lying within the territory of the germ-layer whence they originate; * * and true epithelium or glands, can never come from the derivatives of connective-tissue cells; * * the young brood can only develop to certain prescribed types of tissue which depend on the embryonal origin of the mother cells."

With this brief description of the epithelia I will proceed to the main and I trust most interesting branch of my subject, "the development of the dental germ;" and as I must constantly refer to the illustrations upon the wall, this can be better explained orally.

In this, although I shall refer to different authorities, I shall follow principally Drs. Legros and Magitot, from whose work on the "Origin and formation of the dental follicle, etc.," many of the illustrations are copied.

DISCUSSION.

[The essayist then proceeded to give an extemporaneous discourse upon the development of tooth germs, occupying fully an hour and a half, which was listened to with the closest attention by a very large audience. The subject was made easily comprehensible, even to non-professional attendants, by frequent reference to numerous diagrammatic drawings in colors, executed by the lecturer's own hands. It is a matter of regret that we cannot now publish this lecture on account of the great expense a reproduction of the drawings (without which it would hardly do justice to the author) would entail. We cannot, however abstain from expressing the hope that we may soon see it in book form, so that the valuable information it contained may become as widely desseminated as possible.]

DR. BLACK:—After such a display of knowledge it would seem that uothing could be said, except in commendation. He had never heard a better presentation of this subject, nor seen in the works of our best authors so good a one.

He had himself studied this subject pretty closely from sections taken from the human fœtus at the different stages of development, and he only wished that the lecturer had followed throughout the evolution of the teeth in a single animal species or in the human fœtus.

But the sources from which he has drawn his material would render this impossible, and he (the speaker), wondered that he has presented this subject so concisely.

We have in the human embryonal jaw this *apparent* groove, (that is represented in the diagram), extending the whole length of the jaw; but, as stated, this groove is always filled with epithelial elements—there is no *real* groove. Had his note-book ready to record any error the Doctor might make, but he had his points well guarded. This is indeed a great subject for the histologist as well as the physiologist. The young hair follicle represented here, (referring to another drawing), is histologically very similar to the enamel organ, and so are all the glands that originate in the external germinal layer.

He must dissent, however, to the doctrine, that the follicles of the permanent teeth are derived from the epithelial cord of the temporary ones. His observations led him to believe that the enamel organs of the permanent teeth are derived directly from the epithelial lamina.

DR. DEAN:—Perhaps Dr. Black has made his examinations on embryos at a later stage of development than those studied by the authors named in the essay and lecture; if so, this might account for the difference of opinion in regard to the origin of the permanent teeth. For if his observations were made on the sixth-year molars, (the budding of the enamel organ of which commences about the 16th week of fœtal life), he would find that *this* did originate from the epithelial lamina.

But the other twenty that correspond to this number of temporary teeth, according to Magitot, Koelliker, Tomes and others originate from the epithelial cord of the temporary follicles; while the 2d molars originate from the cords of the 1st molars, and the 3d from the cord of the 2d molars. Does not make this statement on his own authority, but upon that of the authors just named.

DR. BLACK:—His observations had not been confined to the

development of the sixth-year molars, but all the other teeth have been included.

Dr. Dean :—Was still determined to reconcile the views of Dr. Black with those of the authors cited. Now the enamel organs of the permanent teeth originate and branch off from the epithelial cord, *before* the cord is severed from the follicles of the temporary teeth. But *soon after this*, the cord is detached from the temporary germ; now if examinations are made, at this period, the permanent follicle will *appear* to originate directly from the epithelial lamina; whereas that portion of the cord that is immediately connected with this lamina is the same that furnished the enamel organ of the temporary tooth.

If examinations are made at this stage of development alone, one would naturally conclude that the permanent teeth originated *directly* from the epithelial lamina in the same manner that the temporary ones do.

Dr. Black :—Examined them at various stages of development from the eighth to the sixteenth week, in a great number of cases, and must still maintain that he never has found the *secondary* enamel organ to emanate from the follicular cord of the temporary tooth.

There is a great difference in the development of the teeth in the human fœtus and those of the mammiferous animals; this difference, however, is in the *time* and not in the *mode* of development.

The Transactions of the Medical Association of the State of Georgia, for 1878, contain a report of "one hundred and thirty operations for strabismus." Of this number the author states, "that only three have occurred among the blacks, although the whole number of operations have been made upon those who live in the midst of the densest portion of the black population of the South." "It is so extremely seldom that we find negroes with either over-sightedness or near-sightedness, that it may be asserted as a fact, that they are in a manner exempt from both. Hence they are rarely found to have strabismus of either the internal or external variety."

Anesthetics.

THE ACTION OF ANÆSTHETICS.

The double danger of anæsthetics, arising from their variable influence on the respiratory and cardiac centers, has long been familiar to those engaged in their administration. This double action has been lately studied on animals by M. Vulpian, who has communicated to the Académie des Sciences a note on the subject of some practical interest. The special point which it embraces is the effect of the various anæsthetic agents on the pneumogastric, as shown by the test afforded by the experiments of Weber and Traube on the section and stimulation of the nerve.

Curara, as is well known, does not influence, in any considerable degree, the effect on the heart of faradisation of the divided pneumogastrics. The heart is arrested in paralytic relaxation, but gradually, after some seconds, its movements recommence, even though the ends of the pneumogastrics are still being stimulated. Nevertheless, the effect of faradisation of the peripheral segments of the pneumogastrics is not absolutely the same in a curarised and in an unpoisoned animal. The effect of faradisation of a single vagus is less marked, and the diastolic arrest of the heart is less prolonged under the influence of curara. If the influence of the poison is profound, there is a period during which the strongest faradisation of the pneumogastrics has no other effect on the heart than to accelerate its movements. From this it is evident that the curara does not, as was once supposed, leave intact the cardiac extremities of these nerves.

Anæsthetics, however, have been found by M. Vulpian also to have a marked and very different influence on the excitation of the peripheral extremities of the pneumogastrics, and a still greater influence on the effect of excitation of the central extremities of the same nerves. The effect of chloral hydrate may be taken as an instance of this. If a solution of chloral

be injected into the vein of a dog in a quantity sufficient to produce a profound sleep, complete anæsthesia is produced. The movements of the heart and of respiration continue. Occasionally, especially if the injection has been rapid, the respiratory movements suddenly cease, the heart continuing to beat for some minutes. Commonly the breathing recommences if artificial respiration is maintained for a few minutes, or if the trunk be faradised, intermittently, about twenty times a minute. It is sometimes necessary to continue this respiration for ten or twenty minutes before the spontaneous movements recommence. Occasionally this respiratory syncope, as it is termed by M. Vulpian, occurs only some time after the injection, and during an experiment, perhaps in consequence of the traumatic irritation. Very similar accidents may be observed in animals placed under the influence of ether, chloroform and analogous substances.

Another accident which may occur in dogs under the influence of chloral, is the more or less sudden arrest of the heart's action, either during the intravenous injection or during an experiment involving irritation of the sensory nerves. The respiratory movements continue for some seconds after the heart ceases to beat. It is very rarely that the cardiac contraction can be restored, by faradisation employed at the moment at which the heart has ceased to beat. This cardiac syncope is also observed in animals under the influence of ether and chloroform. It is certainly sometimes due to the reflex influence of nerves irritated during an operation, but occurs as a result of this irritation much more readily in animals under the influence of an anæsthetic than in those which are not, or which are under the influence of curara. The comparative immunity from this accident which is presented by curarised animals is no doubt to be attributed to the influence of the poison in moderating the action of the pneumogastrics upon the heart.

From the phenomena mentioned above it is evident that the respiratory center suffers remarkably in animals under the influence of anæsthetics, and especially under that of chloral. A slight increase in the quantity of chloral in the circulation, or a reflex influence, may arrest its action. So also with the cardiac center. If the experiment of faradising the pneumogastrics is repeated upon animals under the influence of chloral, it is found

that the stimulation of the central ends of the divided nerves arrests the movements of respiration, just as in an animal of the same kind under normal conditions; but whereas in the latter the respiratory movements go on again spontaneously and easily in most cases, in spite of the continuance of the stimulation; they do not return spontaneously in dogs under the influence of chloral, and the animals die unless the faradisation is stopped and artificial respiration employed, either alone or with the addition of intermitting faradisation of the trunk. Sometimes a few seconds' faradisation of the superior segments of the vagus nerve is sufficient to produce this arrest. Thus under these conditions we may have, on faradisation of the central ends of the divided pneumogastrics, the same effect which M. Paul Bert has observed in animals not chloralized—sudden death. If the experiment is repeated in the same dog; the same result may be obtained two or three times, but no more. It is subsequently impossible thus to cause a persistent arrest of respiration. The spontaneous movements return after a suspension of a greater or less duration, although the faradisation of the superior extremities of the vagi is continued. If in the same complete chloralization the peripheral extremities of the pneumogastrics are faradised, the heart is arrested in diastole just as in animals, under normal conditions, and, what is rarely observed otherwise, it may be permanently arrested if the stimulation is prolonged for a short time.

These experiments illustrate very strikingly the phenomena which are sometimes observed in man, and they are of especial value in their proof of the influence which traumatic irritation may have in arresting the action of a centre depressed by the influence of an anæsthetic. But the experiments stop just where we should like them to go on. The differences in this respect, if any, which are to be observed between ether and chloroform is a point of great practical importance, and on which we hope M. Vulpian may be able to furnish us with further information.—*London Lancet.*

CONSCIOUSNESS UNDER CHLOROFORM.

BY HERBERT SPENCER.

A university graduate, whose studies in psychology and philosophy have made him an observer able to see the meanings of his experiences, has furnished me with the following account of the feelings and ideas that arose in him during loss of consciousness and during return to consciousness. My correspondent, describing himself as extremely susceptible to female beauty, explains, that "the girl" named in the course of the description was an unknown young lady in the railway-carriage which brought him up to town to the dentist's. He says his system resisted the influence of chloroform to such a degree that it took twenty minutes to produce insensibility: the result being that for a much longer time than usual he underwent partial hyperæsthesia instead of ænesthesia. After specifying some dreadful sensations which soon arose he goes on to say: ". . . . I began to be terrified to such a wonderful extent as I would never before have guessed possible. I made an involuntary effort to get out of the chair, and then—suddenly became aware that I was looking at nothing: while taken up by the confusion in my lungs, the outward things in the room had gone, and I was 'alone in the dark.' I felt a force on my arm (which did not strike me as the surgeon's 'hand' but merely an as external restraint) keeping me down, and this was the last straw which made me give in, the last definite thing (smell, sound, sight, or touch) I remembered outside my own body. Instantly I was seized and overwhelmed by the panic inside. I could feel every air-cell struggling spasmodically against an awful pressure. In their struggle they seemed to tear away from one another in all directions, and there was universal racking torture, while meantime the common foe, in the shape of this iron pressure, kept settling down with more and more irresistible might into every nook and crevice of the scene. My consciousness was now about this: I was not aware of anything but an isolated

sense of torture, pervaded by a hitherto unknown sense of terror (and by what I have since learned is called 'the unity of consciousness': this never deserted the scene, even down to the very last inaudible heart-beat). Yet I call it a 'scene,' because I recognized some different parts of my body, and felt that the pain in one part was not the same as that in the other. Meanwhile, along with the increased intensity of convulsion in my lungs, an element of noise had sprung up. A chaotic roaring ran through my brain, innumerable drums began to beat far inside my ear, till the confusion presently came to a monstrous thudding, every thud of which wounded me like a club falling repeatedly on the same spot. . . .

"From this stage my lungs ceased to occupy me, and I forget how the struggle finished. There was a sense of comparative relief that, at any rate, *one* force was victorious, and the distraction over; the strange, large fright that had seized me so entirely when I felt myself ensnared into dark suffocation was now gone also, and there was only left the huge thudding at my ears, and the terribly impetuous stroke of my heart. The thudding gradually got less acutely painful, and less loud; I remember a recognition of satisfaction that one more fearful disturbance was gone. But, while the thunder in my ear was thus growing duller, all of a sudden my heart sprang out with a more vivid flash of sensation than any of those previous ones. The force of an express-engine was straining there, and like a burning ball it leaped from side to side, faster and faster, hitting me with such a superhuman earnestness that I felt as if the iron had entered my soul, and it was all over with me forever. (Not that 'I' was now any more than this burning-hot heart and the walled space in which it was making its strokes: the rest of 'me' had gone unobserved out of focus.) Every stroke produced exquisite pain on the flesh against which it beat glowing, and there was a radiation, as from a molten lump of metal between enclosures. Presently the unbearable heat got less, and there was nothing remaining except a pendulous movement, slackening speed, and not painful. Of nothing beyond was I conscious but this warm body vibrating: not a single other part of me was left and there was not a single other movement of any sort to attract my attention. A fading sense of infinite leisure at last, in

a dreamy, inaudible air; then all was hushed out of notice.

" . . . . There was the breaking of a silence that might have been going on forever in the utterly dark air. An undisturbed, empty quiet was everywhere, except that a stupid presence lay like a heavy intrusion *somewhere*—a blotch on the calm. This blotch became more inharmonious, more distantly leaden; it was a heavier pressure—it is actually intruding farther—and, before almost there was time to wonder feebly how disagreeable was this interruption of untroubled quiet, it had loomed out as something unspeakably cruel and woeful. For a bit there was nothing more than this profoundly cruel presence, and my recognition* of it. It seemed unutterably monstrous in its nature, and I felt it like some superhuman injustice; but so entire had been the still rest all round before its shadow troubled me, that I had no notion of making the faintest remonstrance. . . . It got worse. . . . Just as the cruelty and injustice became so unbearable that I hardly could take it in, suddenly it came out a massive, pulsating *pain*, and I was all over one tender wound, with this dense pain probing me to my deepest depths. I felt *one* sympathetic body of atoms, and at each probe of the pain every single atom was forced by a tremendous pressure into all the rest, while every one of them was acutely tender, and shrank from the wound—only there was nowhere to shrink. A little before, I had merely *felt* the cruel element in helpless passivity; now a still more crushing probe came; for an instant it forced all my atoms into one solid steel mass of intense agony—then, when things couldn't go much farther, and all must be over, a sense of reaction emerged; there was a loosening, and I was urged into relief by uttering from my very depths what seemed not so much (at first) a piteous remonstrance as a piteous 'expression' (like an imitation) of the pain: in fact, the sense of woe had also got *outside*, and I *heard* it, a very low, infinitely genuine moan. . . . The next second there was a change: hitherto it had been pain *partout*—now there came a quick concentration, the pain all ran together (like quicksilver), and I suddenly was aware that it was

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*If there were a noun belonging to the verb "To be aware of," like "recognition" to "recognize," it would be the one to use here.

(loccalized) *up on the right;* while, similtaneously with this recognition of locality, a feeling of incipient *resistance* began to be in *other parts* (not that I felt them except just as *other* parts) of me from which the pain had receded. The pain itself was no less intense, rather more vivid, only I seemed to take it in a more *lively* manner: my uttering of a moan was no longer a mere faithful representation out into the air of what was inside me, but I had a slight sense of making an appeal for sympathy: to whom or to what I did not know, for there was no one or anything there. I was just going to utter a yet louder moan,—as a fresh, fearful imposition of force plunged into me—when, there in front of me, to the *left* of my pain, was that girl, with those lovely ankles, and the graceful, Zingari brown stockings. . . I felt, as distinctly as if some one had told me aloud, that I would not make any cry, that it was not the thing.'

"Now came an agonizing, cold wrench, and two or three more successively, in such a hideously rough fashion, that the girl went, and everything was tortured out of me but the darkness and the gigantic racking, swaying torture which was excruciating my right side. An iron force, like a million-horse power, had hold of me, and I was being pulled upward and out of where I was, while I myself seemed another million-horse power which would *not* be pulled: the pain was something to be remembered. But up I came, the darkness got denser (I went so fast); it was vibrating, the dense agony vibrated faster; *I* was quivering, struggling, kicking out; everything was a convulsion of torture, my head seemed to come to the surface, a glimpse of light and air broke on the darkness, voices came through to me, and words; I recognized that a '*tooth* was being slowly twisted out of my jaw, then I groaned imploringly, in true earthly style, as if this was *too much*, and I ought to be let alone now I was getting my head out; then I swallowed in air, made an exertion with my 'chest,' found my 'arms' were pressing something hard, grasped the 'chair,' and pushed myself up out in bewildered light, just as the dentist threw away the second right molar from the upper jaw."

Concerning this account it may be remarked, on the one hand, that the higher consciousness seems not to have been wholly abolished; since there remained certain emotions and certain

most general ideas of relation to objective agents. On the other hand, it is to be doubted whether the partial consciousness which the narrator had during ænesthesia is not, in the description, eked out in some measure by the ideas of his recovered consciousness carried back to them. Be this as it may, however, it is clear that certain components of consciousness disappeared and others became extremely vague, while a remainder continued tolerably distinct. And there is much significance in the relations among them: 1. There ceased earliest the sensations derived from special senses; then the impression of force acting on the body from without; and, simultaneously, there ceased the the consciousness of external space-relations. 2. There remained a vague sense of relative position within the body; which gradually fading, left at last only a sense of those space-relations implied by consciousness of the heart's pulsations. 3. And this cluster of related sensations produced by the heart's action finally constituted the only remaing distinct portion of the *ego*. 4. In the returning consciousness we note at first a sense of pressure *somewhere*; there was no consciousness of space-relations within the body. 5. The consciousness of this was not a cognition proper. In an accompanying letter my correspondent says of it: "'Recognition' seems to imply installation in some previously-formed concept (talking in the Kantian way), and this is just what was *not* the case;" that is, consciousness was reduced to a state in which there was not that classing of states which constitutes thought. 6. The pain into which the pressure was transformed was similarly universal instead of local. 7. When the pain became localized, its position in space was vague: it was "up on the right." 8. Concerning the apparition of "the girl," which, as my correspondnet remarks, seems to have occurred somewhat out of the probable order, he says, in a letter: "I did not recognize her 'under any concept'—what I saw seemed to be almost unassisted intuition in the Kantian sense." 9. The localization of the pain was at first the least possible—the consciousness was of that part *versus* all the other parts unlocalized.

These experiences furnish remarkable verifications of certain doctrines set forth in the "Principles of Psychology." This degradation of consciousness by chloroform, abolishing first the higher faculties aud descending gradually to the lowest, may be

considered as reversing that ascending genesis of consciousness which has taken place in the course of evolution; and the stages of descent may be taken as a showing, in opposite order, the stages of ascent. It is significant, therefore, that impressions from the special senses ceasing early, leave behind, as the last impression derived from without, the sense of outer force conceived as opposed by inner resistance; for this we have seen to be the primordial element of consciousness. Again the fact that the consciosness of external space disappeared simultaneously with the consciousness of external force, answers to the conclusion drawn that space-ideas are built out of experiences of resistant positions, the relations among which are measured by sensations of muscular effort. Further, there is meaning in the fact that a vague sense of relative position within the body survived; since we concluded that by mutual exploration there is gained that knowledge of the relations among the parts of the body which gives measures through which the developed knowledge of the surrounding space is reached. Once more we get evidence that the *ego.* admits of being progressively shorn of its higher components, until finally the sensations produced by the beating of the heart remain alone to constitute the conscious self; showing in the first place, that the conscious self, at any moment, is really compounded of all the state of consciousness, presentative and representative, then existing, and showing, in the second place, that it admits of being simplified so far as to lose most of the elements composing the consciousness of corporeal existence. Whence it is inferable that self-consciousness begins as a mere rudiment consisting of present sensations, without a past or future. Lastly, we have the striking testimony that there exists a form of consciousness lower than that which the lowest kind of thought shows us. The simplest intellectual act implies the knowing something as such or such—implies the consciousness of it as like something previously experienced, or, otherwise, as belonging to a certain class of experiences. But we here get evidence of a stage so low that a received impression remains in consciousness unclasped; there is a passive reception of it, and an absence of the activity required to know it as such or such.—*Popular Science Monthly.*

CHLORAMYL, A NEW ANÆSTHETIC.

TO THE EDITOR OF THE MEDICAL RECORD:

SIR:—Having had considerable experience in the administration of the various anæsthetics in use at the present day, viz., chloroform, ether, etc., and not feeling satisfied with the safety, or rather unsafety of chloroform, or with the many faults of sulphuric ether, which so nearly counterbalance its comparative safety as to preclude its use in favor of chloroform in many cases, I have therefore experimented with various compounds in the hope of discovering a new and better anæsthetic.

Early in the month of April, 1877, while treating an asthmatic patient with the nitrite of amyl, I became impressed with the idea of augmenting the heart's action with this drug, and thereby preventing the tendency to syncope and asphyxia, from paralysis of the heart, in cases of chloroform narcosis.

I then began a series of experiments upon annimals, first administering chloroform and then the nitrite of amyl. Then I began to mix them for use, aiming to get such a proportion of the amyl as would just counteract the paralytic effect of the chloroform. I found that while pure chloroform (Squibb's) would mix readily with the nitrite of amyl, producing a fine clear solution, the chloroform of other manufacturers was unsatisfactory having a milky solution of unpleasant odor. Continning my experiments, I came to the conclusion that a quarter of an ounce of the nitrite of amyl to the pound of Squibbs' chloroform was about the proper strength, and that the combination was far safer for general anæsthetic purposes than chloroform uncombined; indeed, in my hands, and in those of others, so far as tried, it seems to be fully as safe as sulphuric ether, and far more pleasant in its administration, possessing all the advantages of pure chloroform, but without its dangers.

Upon becoming satisfied of the value of my discovery, I named it chloramyl. I first administered chloramyl in June,

1877, as follows: June 6th, I administered the compound to Charles Detrick, a young, healthy man, for the purpose of dressing a badly crushed thumb, both the patient and bystanders being wonderfully pleased with its operation. Next, June 16th, I gave it for amputation of a finger; then June 18th, for extraction of a tooth; since which time I have employed it (chloramyl) in a great variety of cases in both surgical and obstetrical practice. I find that patients usually take it better than chloroform alone, and so far there has not been the first indication of danger from its use. In exhibiting chloramyl the patient's face becomes flushed much sooner than with chloroform; but press the drug right along and the countenance does not become pale. Both the heart's action and respiration are kept up thoroughly throughout the anæsthesia. I have given this prescription to several physicians, and induced them to try the chloramyl with the most satisfactory results. I have also (last month) communicated the same to Professors Maclean, Dunster, and Frothingham, of Michigan University; and have reported my discovery to the Cayuga County N. Y. Medical Society.

Having noticed lately several communications in the columns of the *Record*, from Dr. F. A. Burrall and others, on the use of amyl nitrite as an antidote to chloroform in cases of poisoning, I concluded to publish my discovery. As Dr. Burrall states in his article in the *Record* of July 20th, "With our present knowledge of the antidotal properties of amyl nitrite in relation to chloroform, it is but justice to our patients to have it at hand when chloroform is administered." I agree with him that we should have it at hand, but not in a separate bottle, to use *after the danger had become imminent*, but (as it produces no ill effects) *mixed with chloroform*, in such a proportion as to prevent the approach of danger, by both syncope and asphyxia; for such I claim to be the effect of this combination, and as such I give chloramyl to the medical profession, asking that it may be given a full and fair trial, and trusting that it may become the humble instrument in other hands of saving human life. Not that I would detract from the honors due the inventor of chloroform, for it was a grand invention; but if we can relieve its administration from the embarrassment and danger which have hereto-

fore attended its use, will it not indeed be a great boon to humanity?

The formula I use for chloramyl is

℞ Squibbs' chloroform.....ℏ 1.
Nitrite of amyl.....ʒ 2.
Mix.

But I would suggest that the amount of nitrite of amyl be diminished in long and tedious operations, and on farther trial it may prove best to vary the proportions, the point aimed at being to use just sufficient amyl nitrite, to counteract the paralytic effect of the chloroform. GEORGE E. SANFORD, M.D.

FIVE CORNERS, Cayuga County, N. Y.

TO MAKE CHLOROFORM MORE SAFE IN HEART DISEASES.—It happens sometimes that chloroform, although obviously indicated in other respects, cannot be employed on acconnt of severe cardiac complications. A case of this kind presented itself to Professor Occhini, of Naples. Lithotomy was urgently required for the extraction of a large calculus; but the patient was of very nervous temperament, enfeebled by chronic suppuration, and affected with mitral insufficiency, the pulse being irregular, intermittent, and thready. On consultation, it was decided that an operation was absolutely required, but that anæsthetics were as absolutely contra-indicated. Under these discouraging circumstances, Professor Occhini resolved on trying the preventive effect of ammoniacal inspirations on the chloroform inhalations by which they were immediately followed, the theory adopted by the professor being that the stimulant action of the ammonia on the nervous and vascular system would counterbalance the depressing influence of the anæsthetic. Some preliminary experiments gave encouraging results; the method was then applied; a very large calculus was extracted without any disturbance of the vascular or nervous system, and the patient made a

good recovery in thirty days. Encouraged by this result, M. Occhini made several experiments on patients laboring under cardiac disease in its various stages, and thus confirmed the conclusion at which he had arrived, that the tolerance of chloroform can be insured by the preventive use of ammoniacal inhalations. —*Medical Examiner.*

TURPENTINE VAPOR IN ACCIDENTS FROM CHLOROFORM VAPOR.—Dr. Wachsmuth, of Berlin, has suggested a preventive of those accidents which frequently occur in the administration of chloroform to produce anæsthesia. He says: It consists in the addition of one part of rectified oil of turpentine to five parts of chloroform. The oil of turpentine in vapor appears to exert a stimulating or life-giving effect on the lungs, and protects these organs from passing into that paralyzed state which seems to be produced by chloroform narcosis. Dr. Wachsmuth, while lying on a sick bed, accidentally breathed the vapor of turpentine and he experienced from this a strongly refreshing feeling. This fact induced him to try the plan of adding oil of turpentine to chloroform when the latter was used for anæsthetic purposes. The beneficial results surpassed his expectation.

HINTS FOR THE ADMINISTRATION OF ETHER-VAPOR.—Dr. Cheever, in the course of some clinical remarks published in the *Boston Medical and Surgical Journal*, gives some useful hints on the management of the administration of ether, which are particularly valuable as coming from a medical center in which ether has long been regarded as the anæsthetic *par excellence*. "When the head of an etherised person is allowed to fall too low, you will invariably find that trouble begins. The tongue naturally gravitates backwards, because the patient has no muscular control over it. Whenever this happens, stertorous breathing will at once be heard. It will then be necessary simply to raise the patient's head. The tongue comes forward, and respiration again becomes easy. There is another condition in which an etherised patient becomes tetanic. He has opisthotonos, draws himself forcibly and convulsively backward, and his movements are spasmodic. In such a case, the need is air, and the ether should be withdrawn. If he throw himself

back with great force, turn him on his side, and the condition will pass off. Our patient is nauseated. After he has vomited, he will go to sleep easily."—*Canada Journal Med. Science.*

ETHER V. CHLOROFORM.—From the annual report of Prof. Bardelben's clinic in Berlin, for the year 1876, we learn that death from chloroform occurred in that year four times among twelve to fifteen hundred narcoses. In all four cases a small amount of chloroform was used when death occurred. These accidents as well as an exceedingly large number of troublesome narcoses caused the professor to abandon chloroform and to use chloral-chloroform and ether. All narcoses since have been free from complications.—*Chicago Med. Jour. and Examiner.*

Oral Surgery.

NOTES ON PROF. W. W. DAWSON'S SURGICAL CLINIC AT THE GOOD SAMARITAN HOSPITAL.

REPORTED BY W. C. DENMAN, M. D., INTERNE G. S. H.

REMOVAL OF UPPER JAW FOR GIANT-CELLED SARCOMA.—Mrs. C., æt. 54, admitted May 10th. Present trouble began about one year ago by appearance of what was supposed to be a gum-boil, situated on the external, anterior and lateral aspect of superior maxilla, the right. It gradually increased in size, giving only inconvenience on account of size and occasional pain. Three months ago tumor began to corrode and discharge a material of tobacco-juice color. At same time a pointing and discharge from roof of mouth. During this process the tumor grew less in size. Now occupies the position of the right superior maxilla. Upon its front aspect it is vascular and is no doubt a giant-celled sarcoma, originating upon the periosteum. Dr. Dawson removed it through the mouth, not finding it necessary to make

an incision through the lip or cheek. With the bone gouge he divided the alveolar-process, the nasal process and maxillo-malar junction and literally hulled the tumor out. The cavity was stuffed with sponges. These were allowed to remain until loosened by suppuration, then a carbolic wash was used. The repair up to until she left the house, seventeen days after operation, was rapid.

REMOVAL OF PORTION OF INFERIOR MAXILLA FOR OSTEO SARCOMA.—Mrs. G., æt. 40. Admitted June 12th. Present trouble began last February, by appearance of what was considered a gum-boil, gradually increasing in size but not painful. Tumor now extends from the canine to the wisdom tooth of the right side of the lower jaw, and is about the size of a walnut. Intervening teeth wanting. The crown of tumor has a purplish hue which gradually fades towards its base. Dr. Dawson first pulled the canine and two incisors to be sure of removing all diseased tissue and with the bone gouge hulled the tumor out. Cavity stuffed with sponge; allowed to remain till next morning, then lint covered with vaseline and carbolic wash used. Repair until leaving the house, twelve days, rapid.—*Clinic and Lancet.*

OPERATIONS ON THE INFERIOR MAXILLARY.

BY S. R. BECKWITH, M. D., CINCINNATI.

CASE 1.—Mrs. H., aged thirty-eight, residence Warrenville, Ohio. The lady had osteo-sarcoma of the lower jaw of three years growth. The tumor was very large, causing great fullness of the cheeks, and filling the entire mouth to such an extent, that she was compelled to subsist entirely on fluids taken through a tube, and at times it created much difficulty in deglutition. The surface or shell of the tumor was bony, and filled with solid

fibro-plastic substance. No part of it could be made to spring or yield on firm pressure, and it was evident that nothing short of a removal of the entire jaw could benefit the case; and it was equally clear that the disarticulation could not be made as easily as in health on account of the great deformity and displacement of tissues requiring division. In examination of our authorities no parallel case could be found. Dr. Deadricks, of Tennessee, performed the operation of removal of part of the lower jaw. His case was a cartilaginous tumor of the left side of the jaw, and he removed the bone on one side, from symphysis to ramus. In 1823 Dr. Mott removed nearly one-half of the jaw, on the left side, and eighteen months thereafter he removed the right side from its articulation. In this latter case there was necrosis, and as we shall show, the disease materially modified the danger of the operation, and rendered it comparatively simple. Since that time the lower jaw has often been removed, but in all instances, so far as we know, there existed caries or necrosis. In 1852 Dr. Carnochan removed the entire jaw, and the case was reported in the journals and in phamphlet form. As will be seen by the report, the jaw gave way at its angle, during the operation, showing the existence of some destructive disease. Yet this operation demonstrated the possibility of removal without first ligating the carotids. Guided by the operation of Dr. Carnochan, and influenced by the request of the patient, who preferred death under the knife, to slow and sure starvation, with the advice of Professors Hill and Bissell, I concluded to make the effort to remove the entire jaw. The patient was anæsthetized, an incision was made from about three-fourths of an inch below the ear, along the under side of the jaw to the opposite ear. The facial arteries were ligated, and then the patient was allowed to come out from under the influence of the anæsthetic, as I deemed it unsafe to perform any operation of the mouth, where there is a large amount of hemorrhage, while the patient is under anæsthesia.

A needle threaded with whip cord was passed through the tongue, and given to Professor Brainard, who kept that organ from falling upon the glottis. All attachments were now removed from angle to angle of the jaw, and the patient allowed to rest.

After the hæmorrhage from the last dissection had ceased, she was given brandy and milk freely; her pulse was but little depressed, and she stammered, "Go ahead Doctors, it will come out all right." The difficult part of the operation remained yet to be performed; the tumor being so large that we could form but little idea of the anatomy of the parts. We now passed a pair of curved scissors to the zygoma and divided the tendinous attachment of the temporal muscle; the capsular ligament was opened on its anterior surface and the jaw drawn downward and backward, thus luxating the bone. The remainder of the ligament was divided with all possible care, so as to avoid the internal maxillary artery. The disarticulation of the opposite side, was performed in a similar manner, but the difficulty was much less, as we had the entire jaw to manipulate. The bleeding was pretty active, and several times the patient came near suffocating from the flow of blood in the trachea, and I think had it not been for the active application of sponge probangs we could not have finished the operation. After all the bleeding vessels had been ligated the parts were brought in apposition and secured by wire sutures, through muscles and integument.

The patient made a good recovery, although for several days after the operation her life was in great danger. We sustained her with wine and beef-tea given through a tube, and gave her arnica 30 and aconite 30 internally, and kept the parts moistened with "arnicated" water.

This is the only instance I have ever seen of an osteo-sarcoma, or any other tumor affecting the whole jaw, and even if I should meet another such case, I fear an effort at removal would not be so fortunate.

Case II.—Wm. S., aged ten, residence Fairfield, O. He had received a fracture of the inferior maxillary, on the right of the symphysis between the first and second molar teeth, about one year before he was sent to me. The fracture was not detected at the time of the injury, and in a few months, the soft parts, and each of the broken ends of the bone, became ulcerated. When I examined the case I found the body of the jaw on the right side, necrosed, and an adhesion of the cheek to the bone.

There was also an opening in the cheek, through which the pus was discharged. I supposed that a removal of the affected part, from the symphysis to the angle would be all that would be required. So I made a vertical incision through the soft parts along the symphysis, and another along the border of the angle. The facial artery was tied at both ends, and the flaps were then reflected so as to expose the whole body of the bone. The tongue was secured in the same manner as mentioned in case one, and the bone was severed at the symphysis by a chain saw, and readily removed to the part of the fracture. We now sawed through the angle, when it was found that the ramus was also diseased. The incision was then carried upward near to the ear; little difficulty was experienced in disarticulating. I now fully comprehended how easily disarticulation could be accomplished in a case of necrosis, compared with one in which the ligaments of the joint were healthy. The patient soon recovered. In one year I again saw the boy; a cartilage had filled the space formerly occupied by the bone, and the contour of the face was not materially altered.

Case III.—Dr. E., of New London, O., had necrosis of the lower jaw for several years. I visited him, fully expecting to remove the jaw by an incision, as in the cases described, but the bone crumbled so freely under the probe that I concluded to attempt a removal through the mouth. The bone was seized with a pair of strong forceps, and piece after piece was removed until the entire body of the bone was taken away. In a short time the hemorrhage was arrested, and the forceps were then applied to the ramus, and the vertical portion of the bone was removed by disarticulation. I confess I felt considerable fear in attempting to tear the ligaments and other attachments, but my experience in the boy's case, taught me, that the attachments were not strong in necrosis, and the bone being much reduced in size, and the readiness with which the ramus in the first case was removed, gave me confidence in removing the other.

Case IV.—Operation performed before the class, assisted by Prof. Ellis. A lad 13 years of age, was brought to the with necrosis of the upper portion of the jaw; he was anæsthe-

tised, and I was about to remove the diseased portion by dissection—sawing through the sound bone near the diseased part, and extracting the affected mass—when Prof. Ellis suggested that we endeavor to remove it through the mouth. The usual bone forceps were used, and in a short time all of the diseased portion was extracted. The inferior body of the bone was found sound, and it was allowed to remain. About six months from the time of the operation, the father of the boy wrote me that the jaw was entirely filled up, and two teeth had appeared. I answered him that he probably was suffering from an optical allusion, which appeared to offend him. He replied: "I will bring the case to you soon, and you may see if I am deluded." True to his promise, he brought his son, and I found the incisor teeth growing in a well formed jaw. The remaining teeth were also reduplicated, and the patient has now grown to manhood with a good set of new teeth. He is a clerk in a hardware house in Cleveland, and I would not dare to report this singular phenomenon, could I not exhibit the case.

I have removed in quite a number of cases sections of the lower jaw, where the bone was necrosed, all of which confirm the opinion I have expressed, that the operation is a simple one, when the bone is dead in part or in whole. I hope to be pardoned if I have claimed any special skill in the first case, but I am willing to confess, that I experienced much gratification at the time, on receiving a valuable gift from Prof. Ackley, (deceased) who on presenting it remarked, that although he could not consult with a homœpath, no one could prevent him from recognizing and appreciating such an operation by an American surgeon.—*Medical Advance.*

THE ANTISEPTIC DRESSING OF PROF. LISTER.

A large audience assembled to hear the distinguished English professor read a paper on his antiseptic dressing. It occupied more than an hour and was attentively listened to.

In all wounds, said Lister, there are two things to combat, 1st,

the *ordinary inflammation*. 2nd, the *suppuration caused by putrefaction*. A recent wound does not suppurate for twenty-four hours. Proud flesh or granulations always precede suppuration; this is a point of great moment. In certain cases of grafting practice by the method, of Reverdi, we see a union by the first intention though granulations are present. This proves that the granulations in wounds have no tendency to form pus. As soon as a granulating surface is relieved from all causes of irritation it ceases to form pus. A recent wound dressed with phenic oil excites a flow of pus more or less abundant. But if between the antiseptic liquid and the wound we place an isolating substance which protects the wound against the irritation of the antiseptic, usually there is no suppuration, and no granulations are developed. At the end of some weeks a cicatrice is formed without a purulent flow. The protector or protective substance which he employs as all know is a species of silk gauze varnished with copal. It is not as yet, sufficiently perfect to absolutely prevent suppuration of the granulating surface; nevertheless it greatly diminishes it. There is often danger he said in using too large a piece of the protector. The isolating layer excludes the irritant action of the antiseptic; but it is necessary that this extend beyond the gauze on all sides.

Water dissolves at the most $\frac{1}{15}$ of its volume of phenic acid; this solution is very caustic to the tongue. A solution of phenic oil of $\frac{1}{10}$ is less irritant than an aqueous solution of $\frac{1}{20}$. Finally phenic acid combined with resin in the proportion of 1 to 5 is still better tolerated.

For a permanent dressing we should employ a substance which has a great affinity for phenic acid. Now a resin has the advantage of not being soluble in water and does not commingle with the drainage which comes from wounds. The object of the "*Macintosh*" or impermeable tissue placed between the two last folds of the gauze is to completely prevent the drainage from soaking through the gauze, and to conduct it to the margins. Phenic is not the only acid used by Lister. Boric acid, which is milder, produces good results for superficial wounds and old ulcers; but in dressing with boric acid the protection has the disadvantage of removing the new epidermis which forms on the surface. A solution of zinc chloride of $\frac{1}{12}$ he finds very ad-

vantageous in the mouth. A single application of it prevents putrefaction on the surface of the wound however numerous the causes of suppuration may be, as after extirpation of the tongue.

M. Després replied briefly to Prof. Lister and said that air does not exercise an evil influence on wounds. The studies of M. Bouisson on ventilation had very clearly shown this. As to wounds of the mouth, if let alone they nearly always healed without complications. He complained that Lister did not make sufficient account of immovability in wounds, and he (M. Després) does not admit either that the opening of a congestive abscess even with antiseptic dressing constitutes a good practice.

Prof. Lister replied that the wounds of the mouth healed without treatment because the saliva constitutes a natural antiseptic and does not irritate the wound; but the healing is much more rapid after cauterization with the solution of zinc. On the other hand it is quite certain that an abscess by congestion often produces fever and a grave general condition. The opening of the abscess with antiseptic dressing is followed by great alleviation. He does not though pretend to cure every patient attacked with ossifluent abscess.—*Progrés Médicale.*

LISTERISM IN PARIS.

Since the return of M. Alphonse Guérin to Paris, this eminent surgeon has delivered, at the Académie de Médicine, an address on the treatment of wounds which has produced a marked impression. M. Guérin has, it is well known, long practiced an antiseptic method of dressing, which consists in careful and minute cleansing of wounds by a stream of carbolised water (with a strong solution of twenty per cent. of carbolic acid), and their subsequent envelopment in thick masses of fresh cotton-wool; this acts as a filter, excluding septic germs. The method, which precisely accords in plan with Pasteur's first experiments and Tyndall's subsequent verifications, gives admirable results, of

which he gives details. M. Guérin gives his impressions of the Listerian method, which have been agreeably modified by his personal inspection of them, and renders full justice to the method, which carries out in perfection the antiseptic principle. He refers also to the good results of Mr. Callender with simple carbolic dressings, applied with great care as to isolation of dressings, absolute cleanliness, and attention to the details of the patient's condition. The answer to the objections to the antiseptic principle in surgery is very complete; and indeed, so thoroughly has the opposition to this method broken down in France, that we may necessarily expect to see a rapid development of Listerism in the French hospitals, and a correspondent decrease in the mortality from pyæmia, abscess, erysipelas, etc., which till lately offered so habitually shocking a spectacle to the surgical visitors to those hospitals.—*British Medical Journal.*

ON THE USE OF CERTAIN TRITURATIONS.

BY HENRY G. PIFFARD, M. D., NEW YORK.

The high estimation in which triturations are held by homœopaths induced the writer some time since to carefully consider the relative advantages and disadvantages which they possess in comparison with other pharmaceutical preparations in which the medicine is dispensed in a solid form. In the U. S. Pharmacopœia the number of triturations is limited, and includes only the Pulvis aloes et canellæ, the Pulv. aromaticus, the Pulv. jalapæ comp., the Pulv. rhei comp., the Pulv. ipecacuanhæ comp., and hydrargyrum cum creta. Concerning the first four, the Pharmacopœia directs that their ingredients shall be rubbed "together until they are thoroughly mixed." Of the Pulv. ipecac. co., or Dover's powder, it says the ingredients shall be rubbed

together into a very fine powder." Lastly, the mercury and chalk are to be rubbed "together until the globules cease to be visible." In the former instances the effort is simply to obtain the drugs in a state of minute subdivision, and these alone may properly be considered as falling under the designation of triturations. The homœopaths, on the other hand, prepare a considerable number of medicinal substances in this manner, and it becomes a question of interest whether or not it would be advantageous to extend our own list in this direction.

The homœopaths prepare their triturations by two different formulæ, known respectively as the *decimal* and *centesimal* scales. In the first case one part of the drug is triturated with nine parts of milk sugar, and the result designated 1st decimal, or 1x. In the second case, one part of the drug is rubbed with ninety-nine of sugar, and is called 1st centesimal, or 1c. One part of these mixtures is again triturated with nine or ninety-nine of sugar, and the result designated as 2x, or 2c, as the case may be, and so on *ad indefinitum*. In each case the process of trituration is carried on for an hour, and to a considerable extent is effected by the aid of suitable machinery, the object being to subdivide the drug as thoroughly as possible. As many of these triturations contain, in a convenient bulk, the dose that we commonly prescribe, they at once become eligible preparations for our use, provided they are as convenient to dispense,and as uniform and certain in their effects as the preparations that we ordinarily employ. If they excel in these respects, they should certainly be brought into more general use, and it is our duty and privilege, as regular physicians, to avail ourselves of every therapeutical agent, and of every pharmaceutical process that may be better than those heretofore employed. In order to settle in our own mind the relative value of triturations, we have, during the past year, carefully investigated a few of them; more particularly those of mercury, arsenic and iron.

The first chosen for examination was the 1x trituration of Mercurius vivus and it was compared very naturally with our own analogous preparation, the Hydrarg c. creta. Examined under the microscope, the mercury in the former was found to be in a state of extremely minute subdivision, the majority of the separate globules being smaller than red blood-corpuscles, and

many of them so small as to be endowed with Brunonian movement.

Five samples of Hydrarg. c. creta, obtained from Broadway drug stores, were then examined. These were found to vary greatly in their gross appearances and likewise under the microscope. In some there appeared to be a notably larger proportion of mercury than others, and in all of them the metallic globules were very much larger in size (average) than those in the Merc. viv.

Now, when we administer mercury for its specific effect upon the blood or upon particular organs, the first essential is that it shall be absorbed. If the drug is in solution, there is, of course, little difficulty about the matter, but if given in a solid form it must either be capable of solution by the fluids of the stomach, or else its particles must be sufficiently minute to admit of their direct absorption as solids. The fact of the absorption of solids, at one time deemed impossible, has now been so thoroughly demonstrated, and especially as regards mercury, that we are prepared to understand how minute subdivisions will facilitate absorption, when larger particles would pass the bowels without effect, or simply produce local effects, varying with the nature of the drug employed. We should, therefore, expect that a given quantity of the drug being used, the promptness of its specific effects would vary inversely with the size of the particles of which it is composed. If we submit this rational conclusion to the test of clinical experience in the cases of Hydrarg. c. creta. and Mercur. viv. we find it easily verifiable. The latter given in doses containing the same amount of mercury as the former, will produce the more prompt and decided effects.

Turning from metallic mercury to its salts, we find an inviting field for exploration. The mercurious preparations are almost invaribly given in the solid state, while the mercuric are administered both in the solid form and in solution.

We are all of us aware that a single grain of calomel well rubbed up with sugar and given in, say twenty divided but frequently repeated doses, will often produce the specific effect of the drug, while a single dose of twenty grains will as frequently fail to do so. Passing calomel, then, we come to another mercurious preparation, namely the protoiodide. This salt, in its

ordinary condition of medicinal purity, was found, upon microscopical examination, to consist of comparatively large-sized masses composed of apparently smaller granules. Moderate pressure on the covering glass was sufficient to disintegrate these masses, and to resolve them into much smaller particles not exhibiting crystalline structure, and averaging about the size of red blood corpuscles, or a little less. A gelatin-coated protoiodide pill was found to contain the drug in the same fine granular condition. Sugar-coated pills of French and American manufacture, were also examined and the mercury found to be in quite small particles. In all these specimens the drug was in a very minute state of subdivision, and the greater part of it doubtless, capable of direct absorption without previous solution. This is of importance when we consider that this salt is but sparingly soluble.

The first decimal (1x) milk-sugar trituration of the protoiodide was next examined. In this the salt appeared to the naked eye to be very uniformly distributed throughout the powder, and upon microscopical examination was found to consist of extremely minute particles, of decidedly smaller size than in the previously examined specimens. It is to be expected, therefore, that the protoiodide trituration will prove, *cæteris paribus*, more active than the pill, and such we have found it.

Turning now to the mercurial preparations, we find the bichloride and biniodide most in use. For obvious reasons, triturations of the former were not examined microscopically. Gelatin and sugar-coated pills of the biniodide, however, were carefully investigated. In the gelatin-coated pills we find the salt displayed as beautifully perfect crystals of varying size. In the sugar-coated preparations the drug was in small granular masses, held together by some not very soluble substance. In the first centesimal (1c) trituration, the biniodide was apparently well distributed through the powder, and, upon examination, we found its particles very much smaller than in any of the other preparations. The biniodide of mercury is exceedingly insoluble, and there can be no question but that its absorption is, therefore, very much facilitated by minute subdivision. It is, moreover, a powerful irritant, and one would naturally expect that particles too large for direct absorption, or slow of so-

lution, would be apt to produce more or less gastric distress before they are finally disposed of. That the iodides of mercury frequently produce gastralgia and diarrhœa is well known, and personally we believe that this is due to the local irritation produced by them, and not to any elective action of the drug. Since we have used the triturations, however, in preference to the ordinary pills, patients more rarely complain of disagreeable sensation. We have further been enabled to materially reduce the size of the dose in order to obtain the desired effect. In other words: a larger proportion of the drug is utilized for specific purposes, while but a small amount remains to give rise to local irritation.

Besides those already mentioned, we have employed with equal satisfaction triturations of arsenious acid, the iodide and bromide of arsenic, ferrum redactum, aloes, sulphide of calcium, iodide of sulphur, and others, and are prepared to assert, without hesitation, that they are more prompt and reliable than pills as ordinarily prepared, and that in many cases, the medicinal effect being the same, their action is milder and less disagreeable to the patient.

Besides mineral and metallic, many vegetable substances might with advantage be kept in this form, as Aconitin, Atropia, Digitaline, Picrotoxin, Strychnine, etc., in the 2x, and Morphia Codeia, Elaterium, Pilocarpin, etc., in the 1x trituration. In this connection the greater facility for accurate doseage is not to be overlooked.

At present, if but a few doses of one of the more powerful alkaloids is required, a large number of doses must be prescribed in order to secure any approach to accuracy in dispensing. With triturations this difficulty is obviated. They also afford convenient means for the extemporaneous preparation of hypodermic solutions of Atropia, Strychnia, etc., at times when the services of an apothecary cannot be readily obtained. To the city practitioner at night, a few triturations carried in a pocket-case would often enable him to meet emergencies without the hour or half hour's delay in having a prescription prepared. To the country practitioner they are invaluable.

In conclusion, while willing to give due credit to the homœopaths for their development (though not for invention) of this

class of pharmaceutical preparations, we see no good reason why they should any longer enjoy the monopoly of their use.

The triturations referred to above were made by Boericke & Tafel, and some of them I had compressed into convenient doses by Wyeth & Bro., of Philadelphia.—*Medical Record.*

WORKING WITH THE MICROSCOPE.

BY LOUIS AGASSIZ.

The investigation of the structure and gradual growth of the ovarian egg is so laborious that it will be many years before we can hope to have a complete picture of all its phases. The apparatus required for the task is very complicated, and a long training is necessary merely to prepare the student for the use of his instruments. A superficial familiarity with the microscope gives no idea of the exhausting kind of labor which the naturalist must undergo who succeeds in such work. The glance at the moon, or at Jupiter's satellites, which the chance visitor at an observatory is allowed to take through the gigantic telescope, reveals to him nothing of the intense concentrated watching by which the observer wins his higher reward. The nightly visions of the astronomer revealing myriad worlds in the vague, nebulous spaces of heaven, is not for him; he must take the great results of astronomy for granted, since no man capable of original research has time to prepare for the uninitiated the attendant circumstances essential to his more difficult investigations, or train their eyes to see what he sees. So it is also with the microscopic observer. The deeper insight he has gained by long training in steadiness of hand and eye, as well as in the concentration of intellect that makes the brain work harmoniously with them, he cannot communicate. He may interest and amuse his friends and visitors with some easy exhi-

bition of specimens under the microscope; he may open the door into the laboratory of nature, but he cannot invite them to cross the threshold or to enter in with him. I think people are not generally aware of the difficulty of microscopic observation, or the amount of painful preparation required merely to fit the organs of sight and touch for the work. In old times men prepared themselves with fast and vigil for entrance into the temple; and Nature does not open her sanctuary without exacting due penance from her votaries. It seems an easy matter for a man to sit down and look at objects through a glass which enlarges everything to his vision, but there are subjects of microscopic research so obscure that the student must observe a special diet before undertaking his investigation, in order that even the beating of his arteries may not disturb the steadiness of his gaze, and the condition of his nervous system be so calm that his whole figure will remain for hours in rigid obedience to his fixed and concentrated gaze.

SPECIAL MEETING OF THE ST. LOUIS DENTAL SOCIETY.

October 10th, 1878.

Society met at the office of Dr. A. H. Fuller; the President, Dr. Fuller, in the chair.

Members present, Drs. McKellops, Spalding, Eames, Bowman, Park, Whipple, Hall, Keith, Newington and Harper; visitors, Drs. Cornelius and C. Mathiason.

Dr. Fuller stated that the meeting was called to draft resolutions of respect to the memory of Dr. Charles Knower, who was a member of the Society until his death.

Dr. Eames had known Dr. Knower for many years, and had always exercised the warmest feeling of regard and friendship for the deceased; and personally his death was a very great shock to himself. He was a man above reproach, and he had

never heard anyone say anything against him; and it could be truly said that he was a man who did his duty.

Dr. Eames, had drawn up resolutions of regard and respect, which he presented to the Society for their consideration. The resolutions were as follows: (See page 602.)

On the conclusion of the reading of the resolutions, Dr. Spalding spoke of follows:

MR. PRESIDENT:—It is with feelings of the deepest sadness that I rise to say a few words on this melancholly occasion. One of our number, one whom we all esteem as an honorable, high-minded professional brother, as a citizen and as a friend, in the prime of his life, in the strength of his manhood, and one who but a few days ago was in the full vigor of health, has gone from among us; has taken his departure to the other land.

It seems strange to us that death should take place at such a period of life. It *seems* as if he had not yet fulfilled his mission, and that many years of usefulness were yet before him. It *seems* as if, when one has grown to manhood and has so far progressed in a career of usefulness to himself, to his family and to society, that he should be allowed to complete the cycle of life, and to fill out the full measure of days allotted to man upon the earth. But that it is not always so, forcibly reminds us of the great uncertainty of human life. We come and go; we fill the places of those who were before us, and others take our places when we depart. The schemes and plans of men are of but little avail. The designs of human prudence are often suddenly cast aside; for there is a

"Providence that shapes our ends;"

there is an overruling Power that decides our destinies, and determines the length of days which we are each to enjoy.

I rise not Mr. President to eulogize the dead; I rise to speak to the living. The dead need no eulogy before those who are here present, for we all knew him well, and hold his memory in the same high estimation. We can here neither say nor do anything that shall advance him one single step in his new career. As for ourselves we know not who will next be called, the younger may go before the elder, the strong may fall, while the weak and feeble may yet stand. Let us then accept this dis-

pensation in the right spirit! Let us remember that though our friend and associate has ceased to be visible to the outward sense, he is still living; he is still with us in spirit as he was before. Let us realize then that he is not dead! There is no death! Death is but a transfer from a lower to higher condition; and while we mourn his absence from the familiar scenes of life, let our sorrow be softened by the reflection that he has escaped the remaining ills of an earthly life, and that he has anticipated by but a few short years the time when we too shall travel the same untrodden path. I move the adoption of the resolutions.

Dr. Keith said that Mr. Leslie had requested that Drs. McKellops, Bowman, Fisher and Fuller act as pall-bearers.

Dr. McKellops had known Dr. Knower long before he had entered upon his professional career, in fact almost from boyhood, and in spite of political differences of opinion had always found in him a friend. He could not realize that one in the prime of life should be called away, and he could not express the shock that was given, when the news was brought to him, while too ill to leave his bed.

Dr. Spalding moved that the members meet at Dr. McKellop's office, at 2 o'clock, to attend the funeral in a body at 2:30. The motion was carried.

Dr. Keith wished to express his regard by engrossing the resolutions to present to the family.

Dr. Hall moved that Dr. Keith be permitted to engross the resolutions to be presented to the family. The motion was carried.

Adjourned to meet Tuesday, Octobor 15, 1878.

J. G. Harper,
Secretary

IN MEMORIAM.

CHARLES KNOWER, D. D. S. M. D.,

DIED, TUESDAY, OCTOBER 8, 1878.

—AGED 40.—

Resolutions passed by the Saint Louis Dental Society, October 10, 1878,

WHEREAS, Our beloved member and co-worker, Dr. Charles Knower, has been taken from us by death, in the prime of his manhood, leaving his home desolate; and

WHEREAS, we, who, from our pleasant associations with him, knowing and appreciating his sterling character and many good traits of head and heart, desire to give utterance to the respect which is so justly his due; therefore, be it

RESOLVED—1. That in the death of Dr. Charles Knower, the St. Louis Dental Society has lost a true friend and supporter, the community a faithful and tried citizen, and his family a devoted husband and father;

2. That this public demonstration of our sorrow and regret in his demise, be extended to his bereaved family as an expression of our sympathy with them in this sudden and unlooked-for bereavment;

3. That the members of this Society attend the funeral in a body;

4. That a copy of these resolutions be furnished the daily papers and dental journals for publication, and a copy transmitted to the family of the deceased, and spread on the records of the Society.

Editorial.

There has been no time within the last twenty years when the subject of artificial anæthesia has received as much attention from scientific men as the present. Long series of experiments have been made, and careful observation and study have been given to the subject, with a view to discover the physiological action of the substances most commonly employed as anæsthetics.

Certain conclusions have been reached, and they constitute important steps towards the final solution of the different problems which the subject involves. One thing that is now considered as settled is that there is *no* anæsthetic that is entirely safe.

Another point is, that the physiological action of the various substances employed is quite diverse. One acts primarily and chiefly upon the respiratory forces; another upon the circulatory; one produces depression of the activity of certain functions, another excitation, the action in both cases being usually limited within certain prescribed bounds.

One practical result of the investigations that have been made, is the recommendation of the use of stimulants either in combination with the anæsthetic or in alternation with it. The use of alcohol in the form of whisky or brandy, has long been known as a safegaurd against the dangers of chloroform vapor. But the recommendations now made contemplate either the mingling of a stimulant with an anæsthetic so that the vapor of both may be inhaled at the same time, or the combination and joint use of two properly chosen anæsthetics, or of allowing the inhalation of one anæsthetic to precede that of another. We have devoted an entire chapter to the subject in the present number, and shall keep our readers advised of such discoveries as may come to light from time to time.

IMPROVEMENT IN ARTIFICIAL TEETH.

The enterprising manufacturer, H. D. Justi, has recently brought out a new style of gum sections which he calls "Continuous Gum Sections." The prominence given to the canine teeth, in these new sections, accompained by an increased fullness of the gums at this point, yet curved backward so as to meet the line of the bicuspid gums, makes it practicable to place the bicuspids in a normal position and avoid the "horse-shoe" form of arch so commonly seen in full dentures. The improvement is a valuable one. The form, relative position and proportionate size of the molars and bicuspids conform more nearly to nature than is usual with artificial teeth. We consider these new sections a decided acquisition and predict for them a rapid sale.

A device for dispensing with platina pins and attaching sections to either plastic or metallic plates by means of a dovetailed grove running the entire length of the section has been invented by Dr. Hall, of Ohio. The means of attachment being in the middle line of the base of the sections, admits of an extension and finish of the inner gums equal to that of the outer, in ordinrry gum sections. Unless there is some difficulty in the manufacture of this new design they will be likely to be substituted for the pin sections where an elegant, artistic finish is required.

GEORGIA STATE DENTAL SOCIETY.

The Tenth Annual Session of the Georgia State Dental Society, was held in the City of Atlanta, commencing July 29, 1878, 10 A. M. President, Dr. M. H. Thomas in the chair. The State Board of Dental Examiners met at the same time and place, and accomplished a very effective work for the good of the profession throughout the State. After an unusually interesting session

of three days, the Society elected the following officers for the ensuing year, and adjourned to meet at Augusta, Ga., on the second Monday in July, 1879.

President.—Dr. W. C. Wardlaw, Augusta, Ga.

First Vice-President.—Dr.M. S. Jobson, Perry, Ga.

Second Vice-President.—Dr. J. A. Chapple, LaGrange, Ga.

Corresponding Secretary.—Dr. L. D. Carpenter, Atlanta, Ga.

Recording Secretary.—Dr. R. A. Holliday, Atlanta, Ga.

Treausurer.—Dr. H. A. Lawrence, Athens, Ga.

Committee of Arrangements.–Drs. Geo. Patterson, Waynesboro, Ga., G. H. Winkler, Augusta, Ga., Saml. Hape, Atlanta, Ga.

L. D. Carpenter, Cor. Sec'y.

A CARD.

Burlington, Oct., 1878.

To P. T. Smith :

As one interested in the honor and dignity of the dental profession, I will ask you to answer the following questions through the columns of this Journal :

Did you ever dispose of your dental diploma for money, friendship or any consideration? Has your dental diploma ever been out of your possession? If it has, who had it and what for? Respectfully,

R. L. Cochran.

The *St. Louis Medical and Surgical Journal*, now near the close of its thirty-fifth year, has increased its circulation four hundred per cent since January last. This unprecedented prosperity says all that need be said of the ability and enterprise which have marked the management of this Journal from the beginning of the year. We learn, with pleasure, that the *Journal* has added special departments to its already plethoric pages, and among them one on Dental Medicine. Each number now contains 112 pages of reading matter, at the low price of $3.00 per year.

Book Received.

TRANSACTIONS OF THE ILLINOIS STATE DENTAL SOCIETY—fourteenth annual session, held at Rockford, May 14th, 15th and 16th, 1878. This volume maintains the previous high character of the proceedings of this Society. We have already transferred one of the papers read at the meeting to our columns, and shall make additional extracts in the future.

TRANSACTIONS OF THE IOWA STATE DENTAL SOCIETY. A notice of this pamphlet was incidentally omitted in our last number, which contained two valuable papers taken from its pages. The Iowa Society shows energy as well as ability, and we congratulate the dentists of the State on the prosperity of its local organization.

Extensive catalogues of Medical, Surgical and Dental works, published by the well known firm of Lindsay & Blakiston, 25 South Sixth street, Philadelphia, together with a copy of the Physician's Visiting List for 1879, designed for fifty patients per week. Indispensable to the medical practitioner. Sold by booksellers and druggists.

HARD-RUBBER APPLIANCE FOR CONGENITAL CLEFT PALATE. By THOMAS BRIAN GUNNING, New York. This small work, with copious illustrations, was received just too late for this number, but will appnar in our next.

THE MISSOURI

DENTAL JOURNAL,

A MONTHLY RECORD OF DENTAL SCIENCE AND ART.

VOL. X.——NOVEMBER, 1878.——No. 11.

ETHER DRINKING.

BY DR. B. W. RICHARDSON.

With both man and beast the taste for and enjoyment of alcoholic drink are mere matters of education. You can educate either of them to take strong drink, and the world, if it liked the amusement, could train up menageries of drunken beasts that would rival the gin-palaces of Liverpool, Manchester, or London itself.

The opinion that no animal save man can enjoy the advantage of indulgence in alcoholic drinks being disproved, there arises a second opinion, that alcohol is an agent unique in its kind for conferring on man the advantages that are sought from its use.

The alcohol which enters into our common wines, beers, and spirits, is called by the chemists ethylic alcohol, or sometimes deutylic. Not many years ago it was unknown that there was any other alcoholic spirit in existence save and except this one alcohol, which could be distilled over from wine and other common fermented drinks. Now we know that there is large family of the alcohols, each member of which is constructed of precisely

the same elements—viz: carbon, hydrogen, and oxygen—with the oxygen element remaining the same, but with the two first-named elements, the carbon and hydrogen, holding different relative proportions. By accident of discovery the ethylic alcohol, or alcohol of wine, was first brought into use, but all the other alcohols have intoxicating properties, varied only in effect by the difference of their physical qualities, one being lighter and the others heavier than the common and long-known ethylic alcohol. The lightest alcohol, called methylic or wood spirit, is a quick intoxicant. It may be driven easily into vapor, and the vapor being breathed, men and animals can be made insensible by the mere act of breathing it, just as they can be made insensible or intoxicated by the vapor of chloroform. Taken in water as a drink, methylic alcohol intoxicates in the same way as the ethylic spirit does, and with the same stages of intoxication.

All the four stages of action are produced by methylic alcohol when it is taken in sufficient quantity, but are brought about more quickly by it than the heavier ethylic spirit, and they pass away more quickly when they have been inflicted on the living animal. A good third of the time for bringing on action as well as for recovery from action is saved by using the lighter alcohol. Those, moreover, who have learned to drink the lighter alcohol in its pure form acquire a taste for it which is as distinctive as the taste may be for gin or whisky or old port, while they tell you that the exhilaration produced is more refined and the after-effect less disagreeable than from other kinds of stimulating drinks.

Up to this time methylic alcohol has not been so much used as one would suppose it might have been. The specimens of it in the market are, as a rule, so impure that there has been a prejudice against it. Yet I have met with those who would drink, with relish, even the impure sort, after a little training in drinking it, when it was made sweet and was diluted with water; while one person with whose history I am acquainted took the pure methylic spirit whenever he could get it, and looked upon it as nectar compared with the coarser spirits on which other and less refined mortals were foolish enough to stake their indulgences.

If common ethylic alcohol be treated with strong sulphuric acid—the oil of vitriol of the ancient chemists—there is formed a light fluid, which distills over, and which, because of its extreme lightness, has been called "ether." Its weight is 729 as compared with water as 1,000. It boils and passes into vapor at 94° Fahr., that is, at four degrees of heat lower than the temperature of the natural body. It has a taste which is very peculiar, and which, to the uninitiated in its use, is certainly not pleasant. The light methylic alcohol yields methylic ether, which under ordinary conditions exists only in the state of gas, but which is compressible into a liquid. Ethylic alcohol yields the ordinary ether of commerce.

The action of the common ethylic ether on man has been carefully studied on the largest scale, owing to the circumstance that it is the fluid used, by the inhalation of its vapor, for the production of insensibility to pain during the performance of surgical operations. The action of the lighter methylic ether has been a subject of special study by myself, and I have reported on it to the British Association for the Advancement of Science. As an ether it is the best and safest of all the anæsthetics, but it is not readily applicable, since it exists only in the gaseous state under the ordinary atmospheric pressure.

When either the methylic ethereal gas, or the ethylic ethereal vapor, is taken into the lungs by inhalation, the effect produced is exceedingly rapid; a full degree of intoxication, with utter unconsciousness and prostration, being producible in a few minutes of time. Still, rapid as the changes induced are, there are presented to the skilled observer four definite degrees or stages of action; (*a*) a stage of excitement; (*b*) of excitement with some confusion of ideas, and imperfect muscular control; (*c*) of loss of mental and muscular control and power; (*d*) of complete loss of consciousness, with entire muscular prostration.

Ethylic ether has been known to the scientific world for many centuries, and it has performed some of the most useful of purposes to mankind. It was by the discovery of its property of producing insensibility when its vapor is inhaled, that the grand rediscovery of the process of general anæsthesia was made in the present century. It was by taking advantage of the comparative insolubility of ether, and its low boiling-point, that I,

some years ago, was able to introduce the process of ether spray for local anæsthesia by cold.

Inhalation of vapor of ether as a mode of habitual intoxication has never been generally adopted.

But in another and singular manner the process of *drinking* ether for the object of causing the different stages of intoxication has been established in one part of this kingdom, and has attained such a degree of extension, locally, as to demand public attention. The phenomena produced by the practice of indulgence in ether-drinking are indeed very remarkable.

When traveling in Ireland last year I was first told the history I am about to relate. I was informed in various towns in Ireland—that in certain districts of the North of Ireland there was a wide-spread custom of ether-drinking, and that it behooved me to go and inquire into the subject, the scientific as well as the social bearings of it being singularly important.

I was directed particularly to Draper's Town, "a village in the mountains of the North," and, accordingly I went there.

We had gathered, from the stories that had been told us about this "village of the mountains," that it was a rude and straggling place. Instead of this, we found it, to our pleasant surprise, to be one of the prettiest places in the three kingdoms.

I was fortunate in carrying with me an introduction, which enabled me to obtain the precise information I wanted, and which confirmed the full fact of the existence of the habit of ether-drinking in Draper's Town and the adjoining district.

There have been several theories started as to the origin of this practice of ether-drinking. That which comes nearest to the truth, as far as I could make out, is to the following effect:

During the temperance mission of the illustrious Father Mathew, that useful social laborer visited the North of Ireland, and in the course of his labors was so successful in the districts to which I am now referring, that practically he brought the whole of the people over from hard-drinking to total abstinence from alcohol. The change was a social revolution for good; and has been effective for good up to the present hour, though numbers of those who took the pledge from the Father have died, and though no one like him has roused the younger generation to the same enthusiastic zeal for temperance. Father Mathew

converted the district to his views. After his visit the whisky bottle and the still fell out of favor altogether, with the most evident signs of improving social progress and happiness. Unfortunately, one day some cunning diabolical spirit brought into Draper's Town the ether bottle. "This," said he, "contains no whisky, nor anything that will do you harm; but a new drink, which you may taste without, in any degree, breaking your pledge. Very little of it, not much more than a thimbleful, is required to cheer your spirits." "The new drink" was thereupon introduced, and has been in operation ever since.

There is an art in swallowing the ether. The drinker first washes out his mouth with water "to cool it;" next he swallows a little water to cool his throat; then he tosses down the glass of ether; finally, he closes in with another draught of water to keep the ether from rising, or, in other words, to cool his stomach, so that the volatile ether may not be lost by eructation of its vapor. In a little time the "trick" is easily acquired by members of both sexes.

The quantity of ether taken at a draught varies with different persons. Mr. H. Napier Draper, who has favored me with two excellent papers on this subject, which he has published in the *Medical Press*, gives from two to four fluid drachms, that is, a quarter of an ounce to half an ounce, as the usual quantity. Before I personally inquired into the question I should have considered the quantity of half an ounce as a dose of ether impossibly large to swallow at once. I am convinced, however, now, that it is an understatement of the usual dose. A confirmed ether-drinker will toss off a wineglassful of the "new drink" and a full-sized wineglass will hold three fluid ounces. It is not all who indulge to this extent, but few take less than half an ounce who take any at all; and from half an ounce to three ounces may be put down as the range of potation.

I have already indicated what is the action of these ethers on the body of a living man or animal when their vapors are inhaled by the lungs. The same effects generally are induced when the ethers are swallowed into the stomach of the ether-drinker. The swallowing of a draught of from three to four fluid drachms is followed by quick excitement, flushing of the face, rapidity of the pulse, elevation of the mind, and rapid, unsteady motion of the

body. The same first and second stages of alcoholic excitement that are caused by wine are developed by the ether, but so rapidly, and running so sharply the one into the other, that the two stages, which are so very distinct in the process of alcoholic intoxication become hard to distinguish. In these stages the ether-drinker is, as a rule, loquacious and "free of his mind," as one observer very tersely explained to me. "He is free of his mind and sometimes shows his teeth, but, generally, laughter like that of a person in hysterics is the sign of ether-drinking." The pugnacious are often inclined to fight in these stages, and if they do fight, they seem strong and struggle a good deal, but without much sense or judgment. There is, however, a great difference between the action of alcohol and ether in another respect. Alcohol, steady in its action, soluble and slow of elimination, clings to its man, holds by him, keeps up his excitement a long time and leaves him depressed, melancholic, weary. Ether, on the other hand, rapid in its action, feebly soluble in the blood, quick in being eliminated, escaping in fact by all the emanations—by the skin, the lungs, the kidneys—speedily releases its victim, and, without causing any great strain on his physical powers, leaves him suddenly a sober if not a wiser man.

The greater part of those who indulge in ether as a drink, are content to stop at the first two stages of intoxication, but some go further, and, passing into a third stage, become at first extremely violent, and after a while quite insensible. They fall dead drunk, lie breathing heavily for half an hour or more, and afterward wake suddenly quite sober. A few exceed this extreme limit and indulge in a poisonous measure. Dr. Morewood, of Draper's Town, who gave me a most careful description of the symptoms produced, told me that a short time before my visit, he was called to a man who had taken a large dose of ether, probably after having also taken some whisky, and who suddenly ceased to breathe. Before Dr. Morewood reached this man he was dead. In three other instances in Dr. Morewood's practice, an all but fatal result followed the taking of a large dose of ether, but by artificial respiration the life was sustained until the ether had time to eliminate from the body; recovery thereupon occurred, but the danger was deathly imminent.

Mr. Draper, in his paper, refers to a case in which the vapor

of ether, in the breath of an ether-drinker, caught fire. The drinker, in this instance, was reported to be always taking ether, when one day after swallowing a quantity, he went to light his pipe, and the fire caught his breath. A person near held the burning man down, and poured water quickly into his mouth, by which the flame was put out, and no great harm was done. I did not hear of this escapade myself in the district, but I have no reason to doubt its truth.

A medical friend of mine who was using ether spray to extract a tooth late at night, unwittingly brought a lighted candle to the mouth of the patient to examine if the whole of the offending molar had been removed. To the operator's dismay, as the patient exhaled a breath of air from his lungs charged with vapor of ether, the vapor caught fire, and but for prompt attention a serious accident might have resulted. As it was, great alarm and some superficial burning of the lips were experienced by the sufferer.

I gathered from my inquiries that, taken as a whole, the symptoms of intoxication caused by ether-drinking are identical with those produced by alcohol, but are of slighter duration. From the first flushing and surface warmth of the first stage of intoxication to the pallor and surface coldness of the last stage, all is the same. I learned also that the taste for ether-drinking is speedily acquired, and that when it is acquired the craving for ether is as strong as ever it could be for alcohol.

I was specially anxious to ascertain whether, under the influence of ether intoxication, crimes of violence, extreme, prolonged and plotted, were carried out in the affected districts. I could hear of none such. I heard of blows being struck during the short fray, and of foolish things that were half said and done; but the description was tempered by the explanation that under the excitement from ether there was not time for the carrying out of a matured design of evil.

Methylic and ethylic ethers produce effects which contrast with alcohol and compare with nitrous oxide. Methylic ether when inhaled, is, to my mind, more pleasurable in action than nitrous oxide. I experience a sense of suffocation from nitrous oxide which I do not from methylic ether; and certainly I can never forget the dream which once followed upon inhalation, not

to complete, but to all but complete, insensibility, of methylic ether gas. It seemed to me, as I came under the influence, that periods of time were extended illimitably. It seemed to me that the space of the small room in which I sat was extended into a space that could not be measured, and yet could be grasped and threaded; as if my powers, mental and physical, adapted themselves for the moment, to the vastness of the space. It seemed to me that every sense was exalted in perceptive appreciation. The light was brilliant beyond expression, yet not oppressive; the ticking of a clock was like a musical clang from a cymbal with an echo; and things touched, felt as if some interposing gentle current moved between them and the fingers. When the inhalation ceased at my own instance—for, as my friend, the late Mr. Peter Marshall, of Bedford Square, who was present, told me, I was sufficiently conscious to know when I had breathed long enough—when the inhalation ceased, the return to the natural state of existence was imperceptibly rapid. As in a dissolving view, I seemed to pass from one state into another by a solution of states; the dreams faded, gradually giving way to the realities of the present, so that for an instant I had to ask which was real and which was unreal, until the mind was steadied and was once again fixed in its old abode. They who have felt this condition, who have lived, as it were, in another life, however transitorily, are easily led to declare with Davy, that "Nothing exists but thoughts! the universe is composed of impressions, ideas, pleasures and pains!" I believe it is so, and that we might by scientific art—and there is such an art—learn to live altogether in a new sphere of impressions, ideas, pleasures and pains.

The action of ethylic ether is in some degree similar to that of nitrous oxide and methylic ether, but in a grosser sense. The dream is not so refined, the insensibility is more prolonged after the fluid ceases to be received by the body, and in every stage the state produced more closely resembles that produced by alcohol. Sometimes, indeed, nausea and vomiting follow on the effect of the ether, after the consciousness has been restored. In plain terms, we have in ethylic ether a heavier substance than we have in the two gases. The nitrous oxide gas and methylic ether are eliminated from the body in the same form

as they enter it—as gases. Ethylic ether, condensible in the body into its fluid form, is less rapid in its diffusion, and is less easy of extrication from the body. It passes all away as ether, leaving the body free of its presence without combining with any of the tissues, or more than temporarily interfering with the functions of the vital organs. But, as the prolonged odor of it in the breaths of those who have taken it shows, it clings longer than its subtiler allies do to the body.

The person under ethylic ether has often a furious dream, or perturbed sleep, of the dreams of which he remembers little or nothing when he re-enters the world. He very rarely experiences ecstacy when he takes ether that is perfectly pure.

Ether has this luxurious advantage over alcohol as an intoxicant, that under it a man may get intoxicated and sober some half-dozen times in the twenty-four hours, and may start off again for the next twenty-four, suffering less than he would suffer from one intoxication, equally deep, induced by alcohol.

The practical experience thus related is fully explained by the physiological reading of the action of ether, and is confirmed by them to the letter. A fluid so comparatively insoluble in the blood and other animal fluids, as ether is, is comparatively negative in its action. It enters into no durable physical combination with any part or structure—it undergoes no chemical decomposition in the body—volatile as well as insoluble, it is easily liberated from the body; and, after a short time, it leaves the body without infliction of permanent injury.

We know, however, that it is a part of the physiological action of ether to disturb the stomach, even when it has been administered by the process of inhalation; and we know further that in some persons it leaves hysterical nervous states which may, after one prolonged inhalation, remain for several hours.

Some years ago, when I was giving lectures on the action of anæsthetic vapors, I had a pigeon which would walk into the anæsthetizing chamber of its own accord as readily as it would go into its cage or climb on to its perch, and which would compose itself to the anæsthetic sleep at once with the most perfect equanimity. To the lookers-on this proceeding of the bird was a cause of astonishment. The truth, however, was that the animal in question had acquired a liking and craving for the anæs

thetic vapors. Like all regular topers, it had its particular tastes, and preferred the vapor of methylic bichloride to that of ethylic ether or amylene. But in the absence of one vapor it would always put up with another; and whenever it was brought near the etherizing box it would fly to it and get into it as quickly as it could, and the more eagerly if any odor of vapor were diffused in it. I give this as one illustration, because it was so distinctly marked, and will be so well remembered by many who attended my demonstrations. It is nevertheless only one of its kind, and it is not exceptional beyond the novelty of first seeing it or hearing of it. There is no domestic animal, I believe, that could not be taught to acquire the craving for intoxicating vapors and intoxicating fluids.

The history of ether-drinking which I have narrated is a singular phase of social life in this century, and as such alone is worthy of record. It is still more worthy of record as a study of life under aberration; of the extent to which man can indulge in the freedom of his own inventions; of the desires he can gratify by his own inventions, and of the end and result of the gratification. It, with much more than is akin to it, tells us that, free as we are when we are running in concert with Nature, we are stopped when we try to go our own way; that so soon as we strive to make a nature of our own, or to alter the bases of Nature, so soon are we landed on the impossible; that if we try to invent no more than a change of dreams, fascinating as may be the attempt, we must, in the process, either become unintelligible one to the other or sink into the universal silence.—*Popular Science Monthly from Gentleman's Magazine.*

HARD-RUBBER APPLIANCE FOR CONGENITAL CLEFT PALATE.

BY THOMAS BRIAN GUNNING, NEW YORK.

Alexander Petronius, in his work entitled "De Margo Gallico," and Ambrose Paré, in his book on surgery, prove that efforts to relieve those suffering from defective palate, by applying obturators, were made over three centuries ago, and the records of the last fifty years alone show that the endeavors to supplement the congenital palate have resulted in the invention of mechanical appliances which in number and variety are very remarkable; yet the "Report of the International Exhibition of 1876," in referring to the one now submitted, says: "This contrivance is a very marked improvement over all previous appliances to this distressing malformation." Now, that this simple remedy was not devised earlier is owing to mistaken views as to the movement of the muscles of pharynx and palate, both in perfect and malformed conditions, and this, notwithstanding the investigation and study of these parts by the most distinguished physiologists and surgeons.

These mistakes will be pointed out in this paper, but the literature of this malformation is already so full, especially with the recent volume on "Harelip and Cleft Palate," by Mr. Francis Mason, F. R. S. C.,[1] that it is not necessary to notice all varieties of congenital cleft palate, nor need attention be given to the causes of this incomplete development in the fœtal structure.

Normal conditions will be considered first.

The *constrictor muscles* of the pharynx are said to be *inserted* into the posterior median raphe, which lies against the vertebral column, whereas they *arise* on that line; that is, they are fixed at this center of the back of the pharynx, by which the inferior and middle constrictors, in deglutition, *relax* to allow the larynx

1. J. & A. Churchill. London. 1877.

and its support—the hyoid bone—to pass forward and open the way to the œsophagus.

The *superior constrictors*, which may be seen from the front of the mouth, after reaching the upper end of the raphe, are also prolonged by a fibrous aponeurosis to the basilar process of the occipital bone. They are thus firmly held up as well as back. These muscles, which form the upper part of the pharynx, pass off on each side to their insertions on the *pterygo-maxillary* ligament, etc. They thus inclose the tonsils, and the insertions of the muscles which arch down from the uvula.

The *superior constrictor* muscles, while thus firmly held at the back of the pharynx, and also at their termination in front, where they join the attachment of the buccinators, which they resemble, are quite important, for they contract the fauces laterally and draw the tonsils and neighboring parts in, or let them out as necessary.

The hard palate gives support along its back margin to the velum or soft palate, which is seen curving downward and ending at the uvula, which gives insertion to a pair of small muscles—the *azygos uvulæ*—which arise on the spine of the palate bone, and pass along the front of the velum.

The *levator palati* muscle comes forward and inward on each side over the concave border of the *superior constrictor* muscle, and spreads out in the upper surface of the velum, back of the aponeurosis of the *tensor palati*, which last comes down around the hamular process, and spreads out its aponeurosis to the center of the velum and to the palate bone. The *tensores palati* make the velum tense; the *levatores palati* pull it up and back to shut off the nose, and the *azygos uvulæ* muscles antagonize them.

The uvula is also the center of two distinct arches, formed by two pairs of muscles, which are separated below by the tonsils. The anterior arch is formed by the *palato-glossi* muscles, which are inserted into the sides of the tongue. The posterior arch is formed by the *palato-pharyngei* muscles, which go down, one on each side; their anterior fibres being inserted into the thyroid cartilage, while others pass around the sides and back of the pharynx.

In deglutition the pillars of this arch swing around upon the surface of the *superior constrictors* with great rapidity, and come

together behind; the *tensores palati* muscles and *palato-glossi* acting in concert to form the arched band which shuts down against the tongue to keep the food back. The *palato-pharyngei* then act in concert with the *azygos uvulæ*, to press the food down the pharynx.

The *palato-pharyngei* are not associated with the palato-glossi in constricting the isthmus of the fauces, nor does the *superior constrictor* act in deglutition, as supposed, its attachments making it impossible that it can press the food down the pharynx.

The form of the hard palate is such that the tongue can fit it around the inside of the teeth, as in uttering the consonant *t*. The back of the tongue also fits exactly against the soft palate and uvula and this closure can be maintained while the upper part of the soft palate shuts off the posterior nares. This is easily tested by pronouncing the consonant *k*, in which both the nose and mouth are shut off from the larynx, until the tongue leaves the palate, to allow the vowel sound to come out, when only the passage to the nose is kept shut. This double closure is made even in *kee*, in which sound the contact for *k* is on the hard palate, instead of being back on the soft palate as in *koo*. The point of the tongue goes up in *t*, the back of the tongue in *k*, and the lower lip also goes up to form *p*, the upper lip and the hard palate being passive, and the soft palate nearly so, outside of its great function in respect to voice, which is to shut off the nose cavity in all sounds of speech and song except those containing *m* or *n*. At rest, the velum leaves the passage from the nose to the larynx open.

The malformed palate will now be spoken of.

Congenital cleft may be limited to the uvula, or to the front of the hard palate, or it may occupy any part of, or extend through both soft and hard palate, involving the front teeth and alveolar process up into the nostrils. In nearly all cases the soft palate is seen on each side. The back of the pharynx is exposed, and appears comparatively wide and flat, although each corner holds a vertical column of tissue, which in deglutition passes rapidly toward the center of the pharynx along the surface of the constrictors, which are seen to draw strongly across; while the horizontal remnants of the soft palate at the same time narrow the mesial gap. These vertical columns are the posterior pillars of the soft palate, which being ununited are drawn up by the

levator palati of each side; but the anterior fibres of these pillars, which go to the thyroid cartilage, are seen in place against the tonsils. Each half of the uvula is drawn slightly up by a slip which comes from the *levator,* but it draws very feebly upward, the parts, except in deglutition, tending toward the sides, more than up and back. Mr. Fergusson's report of a dissection, made by him, of a cleft palate in 1844, states distinctly that the *superior constrictor* was very full, and he also claimed for the muscle very decided forward action in deglutition; and his statement has hitherto been accepted almost without question.

The back of the pharynx is, however, in full view when the soft palate is cleft, and more especially so when the opening extends through the hard palate, but I have never seen any special action in the *superior constrictor,* beyond that shown in normal conditions. In 1864 I had become convinced that the superior constrictor was incapable of any action which could prevent the use of a rigid appliance to supplement the cleft soft palate, and to the present time in no case has the hard-rubber palate failed to keep its place, to give entire satisfaction, and to improve the speech in a remarkable degree.

It is but justice to note that, judging from Mr. Mason's able work already referred to (p. 93,) Sir William Fergusson's riper experience led to the conclusions respecting the *superior constrictor* which are in accord with my own views, rather than with those expressed in his report of 1844.

Therefore, in brief, in view of the foregoing propositions: There being no forward action whatever of the superior constrictor muscles, a rigid plate can be worn without intermission, not only in comfort, but with improved condition of the mucous membrane, which is covered in, and of the general health, the nose being as free for breathing as in a normal condition of the parts; while the plate also enables the wearer to utilize the muscles of the cleft velum. The palate is easily made, and being of hard rubber does not deteriorate in the mouth. It is not supported by any part of the cleft, and may thus be worn from early childhood without injury to the parts, in fact its support may even lessen the cleft,

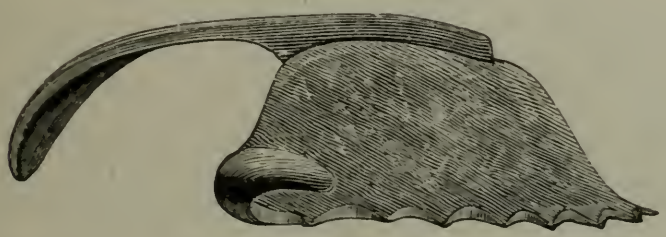
The plate, which is held up by the teeth against the hard roof of the mouth, extends up into the cleft and thence to the

back of the pharynx near the tubercle of the atlas, the end being rounded to allow the sides of the pharynx to close in, during the act of swallowing. This extension into the cleft being spread out over the soft parts on each side, the ununited muscles draw up against it and close off the nasal cavity. The vowel sounds are therefore preserved from the resonance of the nose by the natural action of the muscles, while the nasal sounds are used when necessary, and the tongue is able to form all the lingual consonants, the stiffness of the hard rubber affording the best possible substitute for the muscular firmness of the natural soft palate. To apply this palate, a simple impression of the hard palate and teeth, as is usually taken for the setting of artificial teeth, is quite sufficient, the extension into the soft palate being made by fitting the gutta percha pattern to the parts without subjecting the patient to the annoyance of obtaining a plaster impression of these sensitive and mobile organs. This palate is consequently so simple that any accomplished dentist can apply it, and the patient is therefore comparatively independent.

Early use of this artificial palate prevents unnatural action of the tongue, such as attempts to close the cleft with the tongue when the latter should be free to act in articulation, whether in speaking or singing.

Fig. 1 gives the upper side view of an appliance for a case in

Fig. 1.



which the cleft passes the whole length of the soft palate, but does not reach the front teeth.

Fig. 2 gives the lower front view of the plate shown in Fig 1. When worn, the narrow part is covered on each side by the cleft soft palate, as in Fig. 4.

Fig. 3 was taken from the cast of a large cleft through both the hard and soft palate, in a patient twenty years old. The cleft in her lip had been closed in infancy, and attempts were made to close the soft palate after the cast was taken, but the parts did not unite. The case is peculiar in the absence of the

Fig. 2.

bicuspid teeth and the central incisor, there being only an irregularly-formed tooth on the mesial side of the canine instead of two incisors.

Fig. 4 shows the hard-rubber appliance as adjusted to remedy the deformity exhibited in Fig. 3, after the wisdom-teeth and the right central had been lost through decay, and the mal-tooth removed.

The cut was made from an impression of the plate *in situ* after in had been worn more than four years, day and night.

Deglutition is not interfered with by cleft of the palate in adults so much as articulation or speech. It was, however, necessary to explain the movements in the pharynx and soft palate in swallowing, in order to prove that they do not interfere with

a rigid but properly-fitting appliance. Having shown that the constrictor muscles do not close upon the food, but that they relax and let the hyoid bone and larynx go forward; and as these views are opposed to what is laid down, it is proper to show how the food gets into the stomach.

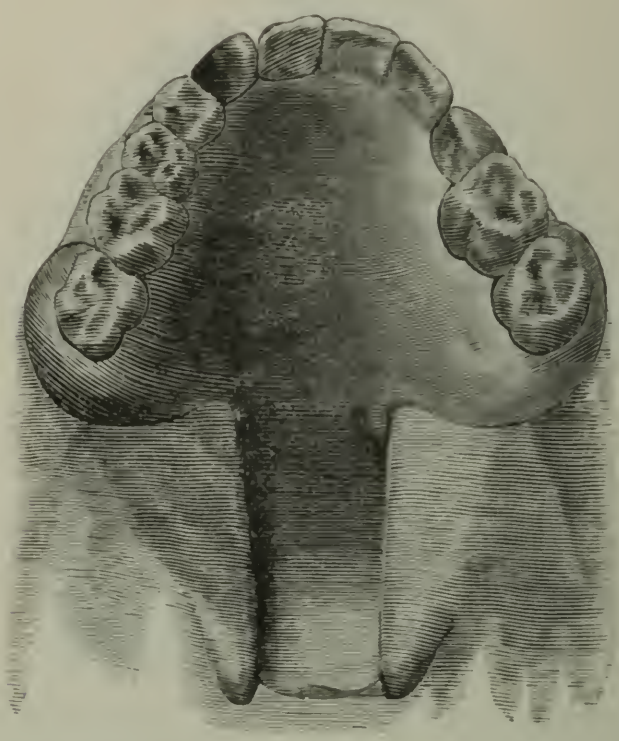
Fig. 3.

Liquids especially are drawn into the pharynx by suction, and also pressed back by the tongue; for solid food the pressure is proportionately increased. When the food has passed into the upper part of the pharynx, it is shut in by a band or welt, consisting of the forward portion of the soft palate, continued down the sides, by the anterior pillars. The upper portion is formed by the action of the *tensores palati* muscles drawing their aponeuroses tight, and the *palato glossi* coming into action, and continuing the curve down on each side of the tongue, at the same time assisting to draw the latter up against this arched band, or welt, by which the food is kept back.

It should be understood that the upper part of this welt is

formed by the aponeuroses, at some distance in *front* of the *uvula* so that the part of the soft palate behind the welt is left free. Through the middle of this, the *azygos uvulæ* muscles pass to the uvula, in the center of the back border or arch formed by the *palato-pharyngeus* curving down on each side, and known as the posterior pillars of the soft palate. These two pairs of muscles are now inactive, as the *levatores palati* have drawn the soft pal-

Fig. 1.



ate up behind, and closed the passage to the posterior nares, while the food is shut in at the front, as before described. At the instant this is accomplished the *palato-pharyngei* act, and come together behind; the *levatores palati* relax, and the *azygos uvulæ* muscles come strongly into action, and draw the uvula and the origins of the *palato-pharyngei* rapidly forward.

The *azygos uvulæ* muscles, which pass from the spine of the hard palate to the uvula, are at this time held *down* to the tongue by the welt or band formed by the aponeuroses before-mentioned, consequently they now, in acting, draw the organs of the *palato-pharyngei* forward and down to the tongue; and as the

insertions of these muscles extend down around the sides and back of the pharynx (crossing each other behind), they, in acting at this time, form a circular layer of muscular fibres, which converge from the circumference of the sides and back of the pharynx, across to the insertion of the *azygos uvulæ* muscles. At this moment the muscles which arise on the inside of the chin draw the hyoid bone forcibly, the back part of the tongue is carried forward, and closes down over the epiglottis until the food falls into the œsophagus, the downward progress of the food being facilitated by the pressure of the atmosphere which is let in by the drawing of the *azygos uvulæ* and the relaxation of the *levatores palati* muscles, while the muscles of the trunk co-operate, and the food enters the stomach. It is shown that the *tensores palati* muscles and the *palato-glossi* act in concert to form the arched band which shuts down against the tongue, and that the *palato-pharyngei* are not associated with the *palato-glossi* in constricting the isthmus of the fauces.

The foregoing explanations show that every muscle of the soft palate is active in deglutition, and that the food is effectually controlled without unreasonable action on the part of any muscle such as that generally imputed to the superior constrictor, which cannot act in deglutition, as supposed; its attachments making it impossible that it can press the food down the pharynx.

NÆVUS, OR THE EFFECTS OF DENTAL OPERATIONS UPON THE FEMALE DURING THE PERIOD OF UTERO-GESTATION.

BY DR. E. S. CHISHOLM, TUSCALOOSA, ALA.

Owing to a case of harelip malformation and fissure of the gum of a newly-born infant, resulting, as I suppose, from the filling of a tooth for the mother while pregnant, I decided to offer a few thoughts upon diagnosis, or rather the importance of correct diagnosis of those diseases and sympathetic affections incident to pregnancy.

The word "diagnose" is derived from the Greek, signifying "I know," and is that part of medicine whose object is the discrimination of disease, the knowledge of the pathognomonic signs of each, and as Dunglison says, "It is one of the most important branches of general pathology."

As this subject affords such a wide field of reflection and study, I will confine my essay to the discussion of but one of its branches: the diagnosis of those diseases and sympathetic affections that accompany pregnancy, and then offer some suggestions as to our duties as dentists toward the pregnant female who applies to us for relief from some of the many ills to which she has fallen heir.

I have often been asked why it is that diseases of the uterus are so much more common now than in former times, and you will occasionally meet with good old grandmothers who will shrewdly remark: "Why, Doctor; when I was young, I never heard of ladies having these complaints; what is the reason we hear so much of them now?" This question is readily answered. It is not a necessary sequitur that because diseases of the uterus were not reoognized they did not exist. These affections, although no doubt much enhanced by the increasing neglect of the general ordinances of health, are of no recent date, but on the contrary, have formed their part in the catalogue of human suffering and death from the earliest periods of creation.

The machinery of the physical world and the revolutions of the sun were no less perfect thousands of years ago than they are at present, yet how profoundly ignorant was man of their true nature—how inadequate to explain what then appeared to him mysteries beyond the ken of human intelligence. But these mysteries have now become universal truths; they have yielded to the progress of science, are perfectly understood, and constitute the every-day lessons of the school-room.

The ample means, therefore, which we now possess of investigating uterine disorders, and the comparative facility with which the true nature of these diseases is arrived at, give to this class of maladies an identity which formerly did not belong to them; and hence, what in the remote periods of the science of physic were regarded as idiopathic affections of the head, chest, abdomen, etc., are now recognized to be symptomatic disturbances, or mere effects of disease in the uterine organs.

The object proper of this paper is to impress strongly upon the minds of our junior members, particularly, the importance of a thorough course of study of this important subject. We should be prepared to diagnose most of the cases that come before us, and I assure you, my young brethren, that the pregnant female will often become your patient; for toothache, one of the most prominent symptoms of pregnancy, will cause her to apply to you for relief. And when she does come, then it is that you should have in store all the information that can be gathered on the subject. You should be able to decide intelligently whether the toothache be a disease or a symptom. The examination should be conducted in that chaste and delicate manner that should characterize a gentleman dentist, but nevertheless the examination should be made. No hasty conclusions should be jumped at, but we should have such command of the subject that we may know where to begin and where to end, and not tire our patient with useless repetitions. There should be no display of instruments, no offensive odors in our offices, no skulls or unsightly objects of any kind; for the extreme impressibility of the nervous system of our patient teaches us the necessity of preventing them from witnessing scenes that are in any way repulsive to them, for although no injury may thereby

be done to the child, the mind of the mother may remain much troubled with anticipation of some deformity.

There is no denying the fact, however, that deformity and "mother marks" may be caused by external causes, such as fright, any sudden shock either physical or mental, and we are satisfied that sometimes the very fear upon the part of the mother, that some terrible deformity or mark has been fastened upon her child from beholding some disgusting or repulsive object, may produce the very calamity for which her fears were aroused. While engaged in the practice of medicine, on two or three occasions females intimated to me that they felt strongly impressed that their child when born would be marked, they having allowed to go unsatisfied a longing for cherries, peaches or some other article of food, perhaps out of season at the time; and, to my astonishment, the mark was found just where the mother declared it would be.

I confess that the subject of mother marks has never been satisfactorily explained in our medical works, and some of our over wise men and fluent writers ridicule the idea of any such thing. But there is one proposition that can not be denied, that in all ages of the world's history, nature has at times deviated from the proper performance of her functions in the reproduction of the human as well as the animal species, resulting in monstrosities, harelip, club foot and a long list of abnormal conditions, rendering the unfortunate victim of either not only a mark for the public gaze, but an object of sympathy, yea, even of loathing by every beholder and alike repulsive to the poor blighted creature itself.

These anomalies come under the head of congenital or connate diseases. Congenital meaning diseases or faulty conformation which children have at birth; while connate, having almost the same signification, more particularly applies to those diseases or affections that may have supervened during gestation or delivery.

This is certainly a subject that should engage the attention of all classes of intelligent people as well as the dentist. If Jacob of old could by setting striped poles in the midst of his flocks produce lambs that were ringed, streaked and striped, the same natural cause that operated then may operate now

I have long since felt that this subject in its different bearings upon the future race of man has not been appreciated and therefore has been underestimated by all classes of society.

A poor dejected woman in abject poverty, maltreated by a besotted husband, can not reasonably be expected to bring forth a child as perfectly developed in its mental faculties as one who is surrounded by all that is calculated to render her cheerful, contented and happy. This idea may appear novel to some of you, but in my opinion it is nevertheless tenable ground upon which to base a theory.

There is no denying that the characteristics of the mother more often than those of the father are impressed upon the child, and it is the duty of the husband to place before the companion of his bosom, so far as is in his power to do so, while she is "enciente," everything that is pleasing to her senses, for just in proportion as she passes the long wearisome months of her pregnancy, resigned cheerfully to her lot, fondly anticipating the happinesss in store for her at the end of her term, just in the same proportion will her offspring partake of her nature. If she be cheerful and happy, her child will be sprightly; but if she passes the time with evil forebodings, afraid to look at any ordinary object for fear of marking her child, ever looking at the dark side of the picture and repelling every ray of hope and sunshine that may seek to enter her breast; her child will make just such a one as we often see, spleenful, spiritless, suspicious, and having inherited an evil nature, it is apt to cling to the unfortunate creature through life Not only our disposition but our sins too are visited upon our children even to the third and fourth generation. Woman, then, is a wonderful organism, through whom may be transmitted our virtues as well as our sins; and we may add that through our ignorance or our temerity as dentists, we are liable to fasten a deformity upon the yet unborn infant that would blast its happiness for life, and be a lasting monument to our shame.

The case of hare lip and shocking deformity referred to as the text for my essay, occurred in Georgia not long since, and is well authenticated. When the mother of the child was but a few weeks "gone," as the ladies term it, she went to a dentist and had an upper bicuspid tooth filled. The operation was a

painful one and the tooth felt uneasy for a long time thereafter, as the patient informed me. In due time she was delivered of a child, and to her and her husband's mortification and surprise, there was an extensive fissure through the lip and through the alveolar ridge and gum, on the same side of the mouth, and in the same position as the tooth that had been filled. They were both impressed at once with the belief that the malformation was caused by the filling of the tooth. From all the light before me I am inclined to the same opinion. When, therefore, a patient who is "enciente" comes to us for relief from toothache, or to have operations performed upon her teeth, we should at once study her temperament. If she possesses that strong will, coupled with that heroic power of indurance and fortitude that many women manifest when subjected to pain, we need not hesitate even to extract a tooth, though this should not be done if it can well be avoided. Palliatives should first be used: should they fail, without making a display of instruments, I would engage her in pleasant conversation, leading her mind away from her present suffering, assuring that it will be a trifling operation, if there be any warrant for such an assertion, and when I consider her as prepared for the operation, I select such an instrument as is necessary, and in a deliberate manner proceed to extract the tooth, without lancing the gum. Just so soon as the tooth is out I remind her of the pleasant nights in store for her, and the improvement there will be generally, now that the offending tooth is removed.

On the other hand, if the patient comes with all her grand mothers, and a score of Job's comforters along with her, each one in her presence asking me of the danger that might ensue from extracting the tooth, I promptly advise that we try every other expedient before a final resort to extraction.

On one occasion I stepped into a brother dentist's office to make a social call, when my ears, instead of being regaled with the sound of pleasant conversation or the busy tick of the mallet, heard the sobs and bemoanings of a lady patient, for whom the Doctor was preparing a cavity for filling. The decay was upon the labial surface of a lower incisor, running around the margin of the gum. All dentists know that these are the most excruciatingly sensitive cavities of any in the mouth. Our brother, I

must say, is a fine operator, and, as is characteristic of him, was making the chips fly, and the patient was letting the tears flow in profusion. She was an intelligent lady and exhibited by her manner and suppressed emotion that she was doing all in her power to bear the painful operation without a murmur, but the pain was more than she could bear; she could suppress her feelings no longer, and said, "Doctor, please extract the tooth or let it alone and allow it to decay away, I will not be tortured thus to save it." The Doctor called me to the chair and asked my advice as to what should be done. I suggested the application of Chlo. zinc or some other pain obtunder. He threw up his hands and at the top of his voice cried out, "Why, bless your soul, I never once thought of it." He made the application, and excavated the cavity with comparative comfort to the patient. When he had finished the operation, his patient turned to me and said, "I will remember you with kindness so long as I live."

Now, my brothers, let us learn a lesson from this narrative. Let us strive to inflict as little pain as possible, not only upon the patient who is "in a delicate condition," but upon all who confidingly place themselves in our power. Let us never have to reproach ourselves after committing an error, by the acknowledgment that we knew better, but really did not think of the proper course to pursue. Let us so act toward our patients that they will ever be ready to say, "I will remember you kindly so long as I live."

I might prolong this essay almost indefinitely in detailing the terrible consequences that might result to mother and child by indiscrimination upon our part in the treatment of our patients. But time with its rapid strides has whirled around another year, and another meeting of our Association, and as is the rule with most of us, I have seized upon the last few hours of the departing year to prepare a paper for our meeting. If, however, I have succeeded in arousing a spirit of inquiry in the minds of those for whom these hints are more particularly directed, I shall feel well compensated for the time and labor bestowed in its preparation.
—*Dental Register.*

LARGE CARTILAGINOUS TUMOR OF THE LOWER MAXILLA; REMOVAL WITH HALF OF THE JAW; RECOVERY.

BY GEORGE LAWSON, F.R.C.S., SURGEON TO THE MIDDLESEX HOSPITAL, AND TO THE ROYAL LONDON OPHTHALMIC HOSPITAL, MOORFIELDS.

The following case of tumor of the lower jaw, which has been under my care at the Establishment for Invalid Ladies, is one of special interest, first from its large size, its position, and the peculiar structure of its growth; and, secondly, from the lady having been the last patient upon whom the late Sir William Fergusson operated in private.

The history of the case goes back to 1865, when she first came under Sir William Fergusson's care on account of a large tumor, bulging below the jaw, and pushing into the mouth. He then removed the tumor, and at the same time took away five teeth from the lower maxilla, which appear to have been displaced by it. She made an excellent recovery, and for a time remained well, but the tumor recurred, and after two or three years was again removed by Sir William Fergusson. Unfortunately the patient had kept no account of the dates of the different operations she had undergone. She was only able to say that she was operated on twice between the years 1865 and 1872, and three times between 1872 and 1876; the last operation being in November, 1876, when Sir William apparently succeeded in getting away the whole of the growth.

On December 26th, 1877, the patient, aged fifty-seven, a stout healthy-looking woman, was admitted into the Establishment for Invalid Ladies for the purpose of having the tumor again removed. Since the last operation the tumor had recurred, and, as she could not have the benefit of Sir William Fergusson's assistance, she had allowed the growth to remain until it had attained such dimensions that she was compelled to seek relief.

On admission, the tumor presented the external appearance shown in the woodcut (Fig. 1). It extended upwards to the

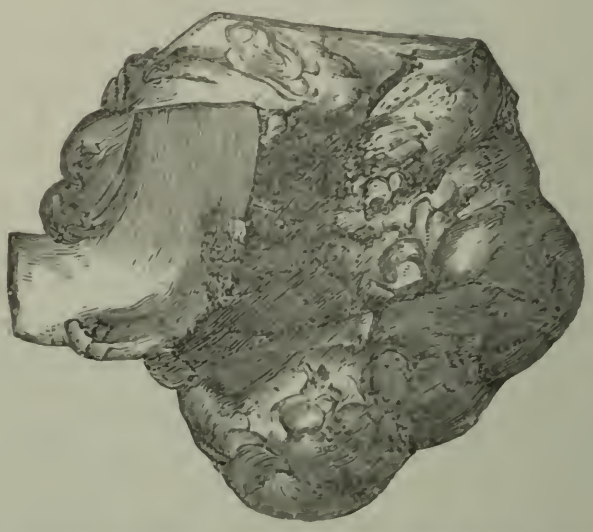
Fig. 1.

level of the lower part of the ear, downwards in the neck to within two fingers'-breath of the clavicle, and forwards it was bulging close up to the nose. Looking within the mouth, the tumor was seen to occupy the greater portion of the cavity; and it extended across the pharynx, against which and the soft palate it pressed. The mouth could be closed, and she could take food without much difficulty, but her breathing was at times troublesome, and especially at night. Sir James Paget and Mr. Bowman kindly saw the patient with me, and both agreed in advising an operation.

On January 7th, 1878, the patient having been placed under chloroform by Mr. Stewart, I proceeded to remove the tumor, assisted by Sir James Paget, Mr. Clark and Mr. Stewart, Jun.

The mouth being opened and fixed by a gag, a ligature was passed through the tongue and handed over to Mr. Stewart, Jun. who kept the tongue well drawn forwards during the whole of the operation. An incision was then made from the lower border of the ear around the greater circumference of the tumor to the center of the lower lip, which was divided. The flap of the skin was raised from the tumor and thrown across the face; the the lower part of the tumor was then freed from its connection with the neck, and the lower jaw sawn through with a chain saw at the symphysis. I again divided the jaw a little below the coronoid process, as I felt it would be safer to disarticulate after the bulk of the tumor was removed, for if the internal maxillary artery were torn during the disarticulation, I could then secure it more readily. Finding that the tumor was firmly wedged above the soft palate, I cut through the upper portion of it, and then without much difficulty removed the great mass which is represented in the woodcut (Fig. 2). I afterwards dis-

Fig. 2.



Portion of the lower jaw with the tumor growing from the periostium on the inner surface.

articulated the portion of the jaw which was left, and took away the remainder of the tumor. The only vessel which bled severely was the internal maxillary, and this was easily secured. The flap of the skin was then replaced and kept in position with

harelip pins at the mouth, and sutures in the other portion. A fold of lint wet with a lotion of carbolic acid, of the strength of 1 to 100, and was then laid over the wound and held *in situ* with a few turns of bandage. The patient was placed in bed, with the head well raised, and the ligature in the tongue was left to enable the nurse to draw the tongue forward if it should by chance slip backwards and cause any difficulty in breathing. Towards evening a sub-cutaneous injection of morphia was given.

Jan. 8th.—The patient passed a fair night, sleeping at intervals. Pulse, 112; temperature, 102°. The ligature in the tongue was removed. During the night an enema of beef-tea, egg and brandy was given, but it was only partially retained; and this was again administered in the morning. During the afternoon the patient was able to swallow a little milk, and from this time she took fluid nourishment by the mouth.

Jan. 9th.—Progressing favorably. Takes her nourishment well. A small portion of the skin at the lower part of the flap is discolored, and is evidently going to slough.

From this date the patient continued to do well. A small portion of the edge of the flap sloughed, but the rest of the wound united throughout the greater part of its extent by primary union.

On the 20th of January (thirteen days after the operation) she was able to get up, and she left the home on Feb. 14th. The wound was then completely closed, with the exception of one small spot near the lower border.

Examination of the Tumor.—The tumor weighed close upon eighteen ounces. It was of a firm consistency, but easily cut with the knife. It was intimately connected with the periosteum on the inner side of the lower jaw, from which it apparently sprang. A portion of the tumor was given to Dr. Thin immediately after its removal, who kindly gave me the following report of his microscopical examination:

"I examined microscopically the portion of the tumor kindly given me by Mr. Lawson, and I believe the growth to be a chondrome of the class named by Cornil and Ranvier, *chondromes hyalin. lobules*. It has the peculiarity that the cartilaginous

tissue is of a very low type, so much so that the determination of the exact nature of the growth was a matter of some difficulty. Successful preparations, however, show that, except in the degree of development of the cartilaginous substance proper, the structure is identical with that described by pathologists as characteristic of these tumors."

Dr. Copeland, the lecturer on Pathology at the Middelsex Hospital, examined the specimen of the growth prepared by Dr. Thin, and concurred in the report.—*London Lancet.*

ODONTOGRAPHIC SOCIETY OF PENNSYLVANIA.

REPORTED BY L. ASHLEY FAUGHT, D. D. S.

A meeting of the Odontographic Society was held on Wednesday evening, September 18th, 1878, at eight o'clock, in the Philadelphia Dental College. The President, Dr. M. Lukens Long, in the chair. After the transaction of the usual business of the Society, the subject for the evening, "Re and Transplantation of Teeth," was introduced and discussed.

Professor James E. Garretson regarded the operation a purely surgical one, but considered the extraction of a tooth for the purpose of filling, and then replacing it, as objectionable. He would refrain from performing it upon the ground that it was somewhat dangerous, and was only a conservative, and not a necessary operation. He had had an occasion once to replace a tooth which had been extracted by another operator through mistake. It had been out of the mouth a few hours. There was considerable rebellion on the part of nature, showing itself in inflammation. He conquered this, however. The tooth had now been in position about seven years, and looks well, excepting a little discoloration. He thought a consideration of each indi-

vidual case very important. What would be safe with one would not be safe with another. He thought that pyæmia might be produced by the operation. It was to be feared.

Professor Stellwagen.—By replantation is meant the extraction and replacing of the same tooth in the same mouth, and in the same position; by transplantation is meant the extraction and replacing of a tooth in a different portion of the same mouth, or the taking of a tooth from one mouth and placing it in another. He thought there was of course some danger of conveying disease, but this must be guarded against. He had performed the operation quite a number of times, with but one failure. Too severely forcing the tooth into the socket should be avoided, as fracture of the alveolar process might be produced. The inflammation that sets in must be combatted, and if he did not succeed in getting it under control in one or two attempts, he generally extracted the tooth and abandoned the operation. This applies more to replantation than to transplantation. He always cut off a small portion of the apex of the root to prevent impingement upon the end of the nerve in replacing the tooth. If the root was blunt he cut off only a small portion, but if it was sharp he cut off more, and rounded the edges after cutting off the end, so that in forcing the tooth into place he might not tear the lining of the alveolus. He always polished the end of the root, and liked to insert a gold screw into a hole drilled into the end of the tooth. He did not bathe his teeth in carbolic acid, as he preferred to have the relations as natural as possible. He did not think there was much danger of producing septic poisoning. He recognized the danger of tetanus, but considered the cutting off of the root above referred to as a preventive.

Prof. McQuillen would have preferred not to express an opinion on the subject, but as it was insisted upon that he should, would say he had never performed the operation. At the same time he recognized that the success attendant upon the cases reported by Prof. Stellwagen apparently justified the operation. In deciding this question, not for others but for himself, the unfortunate experience of Prof. Barker in the replantation of teeth in a patient in which tetanus followed so closely upon the operation that there could be no question of its being the exciting cause, and the subsequent death of the patient, attributed by the

family and friends to the shock to the system, would deter him from performing an operation not of *necessity*, but of *choice*. The sad result attending the case made such a profound impression upon Prof. Barker that he never attempted it again, and up to the day of his death opposed the practice on the part of others. In addition to this, an operator renders himself liable to an action for malpractice in the event of an unfortunate result following such an operation, and, although prominent professional men might testify in favor of the operator and the operation, a jury would more than likely give a verdict against him, as one did in the case of an experienced and skillful practitioner in the northern part of the State, who had heavy damages claimed by a patient on account of the slipping of an instrument, notwithstanding the fact that a number of leading professional men testified that it was an accident which might have happened in the hands of the most careful operators.

Prof. Stellwagen did not think the case of Prof. Barker had been correctly stated. In his recollection of it the connection between the replantation and the subsequent tetanus had not been clearly proved. Even if it had, there was not an operation in surgery, from the slighest to the greatest, that might not be objected to on account of the possibility of tetanus following it. The merest scratch may cause it.

Prof. Garretson said the operation was justifiable on the general principles of surgery. Years ago Prof. Atlee had been denounced in unmeasured terms by eminent surgeons as a murderer for performing ovariotomy, but the success attending the many operations made by him during the past twenty-five years turned the tide in his favor, and he had the gratification of knowing before his death that he was recognized all over the world by surgeons as a benefactor of his race on account of what he had done in that direction. The same thing was true of replantation and transplantation.

Prof. McQuillen had derived his impression of the relation between the replantation and the tetanus from Prof. Barker and the opinion expressed by Prof. S. D. Gross, one of the attending surgeons. He could not recognize, even upon general principles, the connection between ovariotomy and transplantation. The first was an operation of *necessity*, in which life itself might be at

stake, or at least unendurable if not performed. This justified the operation. Transplantation, on the contrary, was one of *choice.*

Dr. Dixon had performed the operation several times with some success, but did not cut off the roots. Adjourned.—*Dental Cosmos.*

IS DENTISTRY A SPECIALTY OF MEDICINE?

BY C. STODDARD SMITH.

The common, in fact almost universal and generally accepted answer to the question contained in the caption is, that dentistry *is* a specialty of medicine. That such is the case has been assumed by colleges, which embody this idea in their announcements and curriculums; by societies which so state in their constitutions; and by writers, journalists, and practitioners generally.

In this paper we shall take issue with this view of the matter and shall present such reasons as occur to us in support of the proposition that dentistry *is not*, or at least *ought not to be*, a specialty of medicine.

If dentistry *was* a specialty of medicine, it would follow that the medical text books and curriculums should embrace a more or less complete exposition of dental science; that a medically-educated man would *by virtue* of his medical education and knowledge, be at least measurably fitted to practical dentistry. Are these propositions true? Is either of them true? Let us see.

First, do the medical text books contain, and do the medical professors teach, anything which by any means could be considered an approach to correct dental teachings? It is notorious that they do not, as could be abundantly shown by extracts from standard medical works, which want of space will not permit us to make.

Incomplete, as applied to these teachings is not the word; *inaccurate* is better, but does not express the fact; ridiculous nonsense is nearer to it in many cases. These books show that the writers, eminent men in their profession, had not the slightest idea of the true cause of dental troubles, or their appropriate remedies. This is not to be wondered at. It is but a short time since they were, on strictly *medical* subjects, floundering in the depths of ignorance; treating diseases as "humors," blistering, purging and dosing in a wholly empirical manner; and, —more's the pity,—they have not wholly gotten over it yet. But this does not indicate that they are competent to teach dentists what they need to know in order to practice dentistry successfully? Do the teachings or the books in any degree fit the student for such a practice?

Then, Second. Is a medically-educated man able, *by virtue of* his medical education, to practice dentistry properly? A moment's reflection will, I think, convince a thoughtful and observant mind that such is not the case. Every one of you *knows* it is not. You know, and I know, that if the preservation of our own teeth, or those of our families, depended upon the treatment they could receive, not from the young medical graduate merely, with the odor of the hospital and dissecting-room still clinging to him, but from the educated and talented physician or surgeon of large experience and great success, posted in all the literature of the profession, eminent in diagnosis; we should stand but an exceedingly slim chance of retaining any of them longer than Dame nature and the destructive influences of the mouth would allow them to remain. Imagine yourself for a moment, with a carious cavity in close proximity to the pulp, and dependent for treatment upon the village doctor, or even on the most skillful medicus you can call to mind. Do you think you would sit calmly and allow him to scrape and punch that tooth because he was a fine anatomist, or because he had eminent skill in the treatment of typhoid or scarlet fever? In all candor, would you not rather trust the village jeweler (supposing him to be an intelligent man), to whom in a half-hour's talk and demonstration you could explain the location of the pulp, and the operation necessary? We had almost said would you not rather trust the village blacksmith, or the machinist from the

shop? For our own part, we would not only sooner trust the jeweler, but if we wanted to make a successful and skillful dentist, we would select the intelligent jeweler, or even machinist, in preference to the doctor, and there would be reason in the choice. The training in the one case would have been in the line of the daily requirements of the dentist, in the other it would have been in quite another direction. Medical education, be it ever so thorough, does not in any degree qualify, it does not even *prepare* its possessor for dental practice; at least not nearly as much so as does the work of the jeweler, or mathematical instrument maker, who are accustomed to handling delicate instruments and to making fine adjustments. Even as regards the comparatively simple and measurably surgical operation of extracting teeth, do you know any, or at least many general practitioners who perform it with any degree of skill? Do you not have any number of broken teeth coming from them as an evidence of their bungling, when they attempt to perform what ordinarily is but a simple operation of what is claimed to be only a "specialty of medicine?" If we are to judge what they know of their profession by what they know or what they can do in what is claimed as a specialty of that profession, they are but a sorry set of men to be intrusted with the life and health of their fellow creatures. I have a better opinion of them than that. I believe their knowledge and ability on *this* subject, is not an index of their skill and success in their own department. They *do* know medicine, but they *don't* know dentistry; and the best of them know they do not. The more intelligent and enlightened they become as regards dentistry, the less they want to meddle with it or its operations, unless indeed they become dentists.

So much for the skill; now for the knowledge. I need but to refer to the oft-told tales of doctors who treat alveolar abscess for months supposing it to be erysipelas, who treat neuralgia as a constitutional disease, because the "teeth are all sound," or have fine "solid" fillings in them; who do not know that a wisdom-tooth may cause almost any trouble about the face; of the surgeons who gravely pronounce an old root covered with salivary calculus, to be an "osteo-sarcoma"; of the almost universal practice of the M.D.'s who prescribe acid medicaments in

blissful ignorance or willful disregard of their effect upon the dental structures; of the doctor who assures the parent that the sixth-year molar is a milk tooth, and should be extracted. Every one of us has seen more or less of this sort of thing; every one of us knows that these accounts are usually accompanied by the statement that the thing was "done by one of our *best* physicians." These things show, not only that medical men, *as such*, have no *skill* in dentistry, but that they are willfully deficient in *knowledge* as well; in fact, they are but little above the intelligent non-professional in either respect.

And further; do medical men necessarily or even usually make the most successful or skillful dentists? We will not say what has been said, that *M. D.* stands for miserable dentist, but we will say that in our opinion, as a rule the M. D. members of the profession are not at least any better than the rest; and we do not believe they will average in ability as well as an equal number of equally intelligent non-medical men. Call to mind those of your acquaintance and see how they stand. Go abroad and see how the long, scholastic and medical European training makes fine operators, or rather see how it does *not* do it.

The main reason, as we understand it, for claiming that dentistry is a specialty of medicine, is that the teeth are a part of the human frame; that they and the adjacent parts are subject to disease; and that he who treats those diseases properly must understand the human frame, and the treatment of disease; *ergo* he is a physician. Indeed it has been broadly stated that if we are not medical specialists we are a set of carpenters. But let us see if this statement is really true—if this conclusion necessarily follows. Granted that the teeth are a part of the human organism, and subject to disease, which none will deny. Granted that a knowledge of anatomy, of physiology, of therapeutics, is necessary to the proper treatment of dental lesions. Does it follow because the medical man must also study these,—because both he and the dentist are obliged to get a part of their preliminary information from the same text books,—because certain knowledge underlies both professions, that the one is a branch or specialty of the other? All knowledge is founded upon certain substructures which are common to all branches alike. What sort of an argument would it be to say that architecture was a branch or

specialty of astronomy, because both the architect and the astronomer must understand mathematics, and must occasionally use the rule of three in working out their problems; because both make drawings upon paper to record the work of their brains? Shall we say that pharmacy is a specialty of medicine because both require a knowledge of drugs and chemicals? Shall we say that the maker of artificial legs is a medical specialist, because he would need to understand the anatomy of the leg in order to construct his substitute, and because he has to deal with living tissue when applying it? The temple of science is not a collection of columns, each standing upon its own pedestal, and each crowned with its appropriate bust or sculpture. It is rather a magnificent edifice, whose foundation stones are planted upon the solid rock of truth, and are interlaced and interlocked; its lower stories are all communicating, and all subservient to the uses of the upper parts, from which rise the several spires, cupolas, turrets, minarets and towers devoted to the various branches of science and art, differing, it may be, in architecture, in height, in magnificence, but all alike parts of one harmonious and imposing whole.

It is true that the dentist and the physician must have much knowledge in common; but it is not therefore true that dentistry is a branch of medicine. Though there is much in common, there is more that is not so. What has the physician (as such) to do with metallurgy and plaster-of-paris, and sand and zinc, and tempering steel; with the cohesive properties of gold, the proper vulcanizing point of rubber, or the manipulation of celluloid? What does he know,—what in the nature of the case *can* he know, about the thousand delicate manipulations of the skillful dentist? His time and brain are full of symptoms and doses; if he knew ever so much dentistry he would not be able to use his knowledge. What has the dentist (as such) to do with obstetrics, with ophthalmology, with cardiac disease, with lung or liver disease, with cerebral disease, with venereal disease? Why should he waste his time, and that to no purpose, in studying these diseases, their symptoms and their treatment? We say waste his time, not because such knowledge is not desirable, and might not be valuable; so might a knowledge of chemistry, or of many other things; but who expects a dentist to be a

thorough chemist, and how is it possible for him to be one? Chemistry is not a by-play, a thing to be mastered in odd moments; it is a life-study, and enough so to engage the ablest minds. We say waste his time, because all the knowledge that he might obtain from books on these subjects, or even from a hospital experience, should he have it, would be utterly useless to him in his life work; not because he might not have occasion to use, but because when wanted he could not depend on it. Such knowledge, to be of any practical use, demands not only preliminary study and clinical experience, but constant and ceaseless observation and practice in order to render it of any reliable service, which, by the nature of the case, is out of the question. Which of you, if you filled a tooth but once a year or once in five years, could do justice to the work? What graduate (unless he be possessed of an exceptional memory), can tell three years after commencement the names of the muscles, or the bones, or the origin and function of the nervous trunks? Who of you would trust the life of a dear one in a crisis, with a man who, though he might *know* the symptoms of the fever, was not practically familiar with the thing itself?

We say his waste of time, not because there is not much in these things that is desirable and proper for a dentist to know, but because it is utterly impossible that he should know all or even any considerable portion of what is just as desirable and proper to be known. Dentistry itself is a life-work, a life-study; it takes a whole man to be a dentist, and it should occupy the whole attention. For a man to undertake to thoroughly master all that is collateral to it, would be like the attempt of the landshark to buy all the land that joined him. He would soon find himself upon a limitless expanse. The thing is impossible; it cannot be done. To attempt it would be to frustrate the objects aimed at, for no time or strength would be left for the thing itself. And when it comes to choosing, as it certainly must come, it is the part of the wisdom to choose that which will best fit for the practical realities of one's chosen pursuit. In ordinary education this is being more and more generally realized; it is recognized that the study of the classics and other branches do not tend to fit men—indeed it is sometimes claimed that they *unfit* them—for the practical business of life; and, con-

sequently, technical and polytechnic and other practical courses of study are more popular than classical. The ideal dentist may be fully educated in chemistry, in metallurgy, in physiology, in therapeutics, in anatomy, and all kindred and cognate sciences; but that ideal dentist will never exist while flesh and blood and human capacity remain as they now are, simply because his existence would involve physical impossibilities.

Let us not be misunderstood. We go for the broadest, the highest, the deepest culture possible, in all departments of human activity. But life is short and art is long. It is given to but few men to become possessed of eminent or even of tolerable knowledge in more than one department; it is, in fact, given to but few to become really eminent in even one department. The great mass must rest content if they attain sufficient knowledge to enable them to become efficient workers in any single department of the world's great work-shop. But let every man *first* possess himself of just as much preliminary education as his position, means, and ambition will enable him to get; then, having settled upon his calling, master that; *afterwards*, let him acquire just as much collateral or other knowledge, as his situation and justice to his chosen occupation will permit. But let him not fritter away his energies in an attempt to make a quart measure hold a peck, or a blanket cover an acre; to master all the branches of medicine because he wishes to be dubbed a specialist.

Far better will it be, both for him and his patients (if he is to be a dentist), that he spend his time and powers in obtaining that skill which he will need every day, and of which there is no danger of having too much.

But it is said that the greater includes the less, and that anything else than a full M. D. is but a "partial culture." The greater does include the less; but who said that dentistry was less than medicine? That is assuming the very point under discussion; arguing in a circle. Those who claim that dentistry is a specialty of medicine, would make it *less; we* claim that it is the proud *peer* of medical science. Not in age, it is true; we cannot look down the vistas of the past and see an unbr succession from the times of Galen and Esculapius. But in our vigorous manhood, in the skill and certainty we have

attained in the performance of our operations, in the "good that we can do" to suffering humanity, palliative, remedial and prophylactic, we are certainly the peers of any craft, profession or calling, be it ancient or modern, be it professional or mechanical. We are *not* "the less," nor are we included in the greater.

"Anything short of a full M. D. is a 'partial culture.'" We have shown in what seems to us an unanswerable argument, that an M. D. does not imply, or even indicate, a capacity to practice dentistry. As to the statement that an education which fits a man only to practice dentistry, is but a "partial culture," we admit it; it *is* but a "partial culture." But show us the inhabitant of this sublunary sphere, who has anything else than a partial culture. What title conferred by mortal man, indicates that its professor has mastered all that is to be known; that no worlds in the realms of knowledge remain for him to conquer; that all the cosmogony and theology, of the here and the hereafter, is to him but as a lesson learned? A "partial culture," it is true; but, alas for human nature, it must await translation to another sphere, where knowledge and existence are alike infinite, before it can hope for more than this. A "partial culture?" yes; but Newton, the great and erudite philosopher, to whose acquirements few, if any, can aspire, much less attain, was forced to admit, at the close of his life, that so far from crossing the great ocean of knowledge, all that he had done was to stroll along its shores and gather a few pebbles from the beach.

The fact is, and it cannot be disputed, that nine-tenths of the practice of dentistry is mechanical. It is worthy of notice, that the more completely we accomplish that thing in regard to which we talk so much, and we fear accomplish so little—the enlightenment of the public—the more complete the mechanical character of the practice becomes. That is, the better care people can be induced to take of their teeth, the oftener they submit themselves and their children for treatment, the less of disease as such, as distinguished from dental caries, we will have to take cognizance of, and the simpler our operations as a whole will become. If dental caries is a disease at all, the treatment of it (simple caries, of course, we mean) is purely mechanical. And sometimes we think that, with all our boasted progress, we who

can circumnavigate the globe, can put a girdle around the earth in forty minutes, can tunnel under lakes and rivers and mountains, can talk through wires and make the lifeless iron speak, who can count the very stars of the heavens, and weigh the sun as in a balance—ought to be ashamed of ourselves when we are compelled to admit that we cannot put a gold filling into a miserable cavity in a tooth, so that it will arrest decay, or find something else that will do it.

But dental practice is not *all* mechanical; else it were a trade as is the tinker's, as it was when it began, or as is the barber's trade to-day. It requires, with this mechanical dexterity, education of the brain, to know the characteristics of the parts on which it operates. It requires judgment, study and thought all the way through, and these constitute it a profession. But it is a pursuit *sui generis*, of its own exclusive kind, and, as I maintain, separate and distinct from all the rest. An education of the fingers far exceeding that of most of the trades; education of the head as well as the hand; judgment, skill, dexterity, and all of the highest order—are not these qualities sufficient to give us a foundation upon which to rear our own edifice, without being attached like a lean-to to the great temple of Esculapius? Do we gain dignity by clinging to the coat-tails of medicine, clamoring for "recognition," instead of standing boldly up and proclaiming ourselves, as did the infant colonies, free and independent? Away with such servile cringing—such degrading sycophancy! *They* do not want us within their doors; let us manfully stay outside, and show them that while we understand *our* business, we do not claim to understand theirs. Let us show them that we mean to be *dentists*, and not medical specialists. Let us know enough of the branches common to both professions, to enable us to consult with them intelligently; enough of their profession to know when we should hand our patients over to them. Let us respect their rights and knowledge in their department, as we ask them to respect ours, and not interfere with their pills and powders, or undertake to treat teething children or miasmatic influences. Let us ask them to study so much of our professional knowledge as to know enough, when anything is the matter in the region of the mouth, to consult an intelligent and skillful dentist, and be willing to abide by his

advice. And let us, during such intercourse, not endeavor to create the impression upon the mind of either the physician or patient, that we are physicians, which we are not, and understand medicine, which, from the nature of the case, we cannot; but rather, let us show by our conversation and opinions, but above all, by our operations, that we are *dentists* and understand *dentistry*. Let each profession know thoroughly, so far as necessary to each, those branches which underlie both in common. Let us know in addition all we can of the other's profession, as we do of all other knowledge which goes to make us intelligent, educated and well-informed citizens. Let us make both the medical profession and the community respect our skill and attainments; but do not let us lay claim to being what we are not. Thus, side by side, hand in hand, let the two sister professions go together, each according to the other all the honor, dignity and knowledge to which each is entitled, fraternizing and consulting with each other and laboring together and in unison, for the good of our fellow men.

DISCUSSION.

DR. BLACK:—Did not think the paper went over the right ground. It doubts whether a medical knowledge is necessary, but yet cannot possibly get to the end without admitting that the dentist, to consult with the physician, would require a knowledge of medicine.

Almost every dentist has felt that he needed to know something of other diseases than those of the teeth. Throughout his practice, he will be more successful the better he understands the laws of general and specific diseases. The oculist, though a specialist, gained his knowledge in a medical college, and the speaker believed the time would come when there would be a chair of dentistry in every medical school.

We must be either "tooth picks," or we must understand the laws of diseases and remedies.

Did not mean that dentists should be posted on details of treatment of all diseases, but that they should obtain a good general knowledge of pathology—and where could this be

obtained but in a medical school? The time has come when our profession must go either up or down; it must go up through its understanding of these things.

Dr. Cushing:—Did not care whether we were called medical specialists or not; but we certainly must strive to become first-class dentists, and he knew of no other way than through a knowledge of medicine.

We do not want to become medical practitioners, but we should have a knowledge of the general principles of medicine. If these do not underlie our specialty, he did not know what did.

Combining dental schools with established medical schools, it seemed to him, was the better plan, in order to furnish the best advantages to the student.

Dr. Crouse:—Was pleased with the writer's enthusiasm, but does not like the effect a residence in New Jersey has had upon him. If dentistry was merely to stuff a tooth with gold, he could make an operator out of any boy without any previous special training.

Is it not the province of the dentist to instruct the parent in matters requiring a knowledge of physiology?

All the dental colleges attempt to teach something of medicine, but he should prefer to go where this knowledge is supplied thoroughly and completely—and what better place could there be than a medical college? Was sorry he did not take a course in one before entering his specialty.

Dr. Dean:—Agreed with the statement that we should have all the education we could hold—but it must be of the right sort.

A dentist should have such education as will qualify him to occupy the place of a professional man. We must, however, discriminate between what was necessary and what would be superfluous. In an entire medical course there are many things which would be of no use to us as dentists, and the time occupied in grasping them can be more profitably occupied in the study of things of more special value to us.

Dr. K. B. Davis:—Believed he could teach a man more of

dentistry in three years than a medical man who does not know dentistry, which, if dentistry was merely a part of medicine, ought not to be so. It is well enough to get all the knowledge we can—but let it be of the right sort.

DR. J. A. W. DAVIS:—There seems to be an impression that the study of medicine takes away a man's adaptability for the practice of dentistry. He had never seen anyone who had more knowledge than he could hold. He was of the opinion that the teeth were not isolated, but were closely connected with the other organs of the body, of which we ought to know more. The tendency of our profession is toward greater education. A medical training of itself does not prepare one for the practice of dentistry without additional special study; but let the future dentist have this general training before entering upon his special studies, and see how much further he will go than we have been able to progress.

DR. C. S. SMITH:—Did not expect that this paper would be generally endorsed, but it is plain that he had been misunderstood, and he was sorry he had not made himself clear. No one who knew him would believe that he would under-value education. He did not depreciate any amount of education, preparatory or otherwise; wanted a man to get all that he possibly could, but where only a portion is possible, he wanted that to be the most important portion. He believes we do need physiology, and anatomy, and hygiene, but these are not medicine; they are only fundamental to that profession, as they are to ours. It is said by Dr. Cushing, that no one claims that we are medical specialists. He would ask if there was not a series of resolutions passed unanimously by the American Dental Association, with a preamble which read: "*Whereas*, dentistry is a specialty of medicine," etc. This idea is almost universally accepted. These are no newly adopted views of his —no "Jersey notions"—but on the contrary, he has long thought that we should be a distinct profession, and he believes time will verify his views. He does not think those who attack the paper differ with him in reality as much as apparently. The difference, he thinks, will be found to be more in regard to the names of things than as to the amount and kind of education.—*Trans. Ill. State Dental Society.*

MEETING OF THE SECOND DISTRICT DENTAL SOCIETY, N. Y.

A quarterly meeting of the above-named Society was held on October 10th, 1878, at the office of Dr. A. N. Chapman, Brooklyn—the President, Dr. C. F. Allan in the chair.

Reported by Dr. Geo. L. Mason, Secretary.

INCIDENTS OF OFFICE PRACTICE.

DR. C. H. BIDDLE:—I presume you have all received a sample of the "felt foil" manufactured by Mr. Slayton. It occurred to me last Saturday, that I would give it a trial, and report the result to the Society. I filled two buccal cavities in the first and second right inferior molars, for a child thirteen years of age. They were teeth I did not feel like filling with gold, I did not wish to put in amalgam, and I was fearful that I would not be able to keep the teeth dry enough, except with great difficulty, to make a good filling with tin-foil. The material works exceedingly well. I used it in the form of cylinders, and I found there was great cohesion, the pieces seeming to weld one to the other. The directions say we should use smooth-pointed instruments. I do not possess such instruments, but I happened to have a few broken pluggers, and I used those. It seems to me it is a material we might use often in place of tin in teeth that are liable to decay. It can be used much more rapidly than tin. It is like tin in its manipulation, and takes a finish very much like it. The circular also said we might use gold with it and it would adhere. I attempted it, and after trying several pieces I was obliged to give it up.

DR. A. H. BROCKWAY:—I have used the same material for something over a year, in perhaps a dozen cases. I used it when it was furnished in the form of a cake, resembling crystal gold. I like it very well so far, but don't see any special advantages it possesses over amalgam or tin-foil, in many cases, except that in tolerably deep cavities it can be used to fill the main part of the cavity, and gold can be welded to it. I made several fillings in

that way, and, so far as I know, they were successful; but, of course, it takes time to test new materials. I would like to ask Dr. Biddle why he would not use amalgam, and wherein would be the difficulty in keeping such teeth dry.

DR. H. C. BIDDLE:—My reason for not using amalgam is perhaps a prejudice, as I have not been in the habit of using it very much, and my experience with it has not been such that I have any desire to boast of it. There would not be any difficulty in keeping the teeth dry, only I wanted to get through with the child, as she was very restless. I would like to ask Dr. Brockway whether he uses smooth or serrated instruments.

DR. A. H. BROCKWAY:—I use either, but I think it would be better to use instruments with tolerably deep serrations I filled a lower molar two thirds with this material and capped with gold, then broke it up, and the union seemed to be perfect.

DR. I. C. MONROE:—My results are the same as Dr. Biddle's in regard to the adhesion of gold to the foil. I put on the rubber dam and used serrated and smooth-pointed instruments, but could not make the gold adhere, and finished the filling with the felt foil.

DR. BROCKWAY:—What form of gold was used in attempting to unite the two materials?

DR. I. C. MONROE:—I used foil No. 4.

DR. BROCKWAY:—I used crystal gold. That may account for my success.

DR. C. F. ALLAN—I made a filling in a hole drilled in the handle of a tooth brush, and had no trouble in uniting the two.

DR. C. H. BIDDLE:—I can't see the necessity of using gold with the filling. I merely tried the gold to see if it would do what the circular claimed for it.

DR. A. H. BROCKWAY:—I find it beneficial in case s I mentioned, where cavities in the grinding surfaces of molar teeth are pretty deep. I can fill them almost wholly with this material very rapdly, and then finish with gold, thus saving quite an amount of time and material, and, if it is made from tin, it is a

better non donductor than gold, and therefore better for the tooth.

DR. W. B. HURD :—Do you apprehend galvanic action ?

DR. A. H. BROCKWAY :—I got over being afraid of that long ago. I would like to ask Dr. Hurd this question : suppose a gold filling to be put on the grinding surface of a molar tooth and an amalgam filling on the proximal surface, those two fillings being in contact, will there be galvanic action sufficient to make it objectionable ?

DR. W. B. HULD :—If saliva can get between them as they lie in contact.

DR. A. H. BROCKWAY :—That is to say, if the joint be imperfect, so that the saliva can get between, there will be trouble ; otherwise not.

D. W. B. HURD :—Yes, sir, in every case.

DR. R. BREWSTER :—Two years ago I put a large gold filling into a right inferior wisdom tooth. Six months after, the buccal surface crumbled off, and I filled that with amalgam ; and that is perfect to day, and the patient has never had any discomfort from it.

DR. A. H. BROCKWAY :—I presume I have seen thousands of such cases, and I have never seen one that produced any discomfort.

DR. W. B. HURD :—A short time ago a lady came to me complaining that she had constant trouble with one of her teeth ; so much so that she supposed there was some exposure of the pulp. On examining the tooth, I found that gold and amalgam had both been used in it, and the two fillings were in contact. There was a small point where the saliva came directly between the two metals as they were united. I suppose that took place in less than three months after the tooth was filled. I removed the filling and filled the tooth as well as I could with gold, and the trouble ceased.

DR. J. N. FARRAR :—I have met with the troubles that Dr. Hurd speaks of, but when I came to investigate, I found that there was a slight space between the gold and amalgam, so that

the saliva could get in there. From some experiments that I am now making, I am led to believe that this is caused by the actionof the mercury upon the gold.

DR. I. C. MONROE:—I would like to state a case, for the purpose of asking whether there is any one present who has had anything similiar. It is the first of the kind that ever came into my hands. This summer a lady was sent to me, complaining of pain in the tongue and side of the face. Seven years ago she had the right inferior wisdom tooth extracted, and immediately the pain commenced. She called upon her dentist several times but could get no relief. She was recommended to others, and still getting no better, finally went to a physician. There is no inflammation or swelling, but occasionally there is a little purple spot, about where the tooth was extracted. For the past two or three years the physician has cut it open when it appeared and then she had relief for a week or two. When it healed over again she would have pain again. When she came to me the physician had, four or five days before, made an incision there. I put in a piece of cotton, which opened it so that I saw the bone clear and clean. Examining it through a magnifying glass, I discovered a spot full of little holes as fine as a cambric needle, with a mark around it, as though it was the end of the root. I took the burring engine and burred down, becoming more and more convinced that it was the apex of the root broken off in there. I kept on burring until it became very painful, and then ceased for that day. The next time I tried, and when I was just getting at the apex of the root, the burr hurt her differently, and she exclaimed that her lip was paralyzed. That continued rather severely for a few days, but finally passed off to a great extent. I continued dressing it with iodine mostly, and she became very much better; still, she is not entirely free from pain.—*Dental Miscellany.*

The remainder of the discussions was devoted to the subject of the "New Departure." We omit this part of the report for the reason that nothing was presented with which our readers are not already familiar.

REUNION AND RESTORATION OF DIVIDED NERVES.

BY C. G. WHEELHOUSE, F. R. C. S.

In the *Lancet* of June the 1st of the present year, a series of experiments are recorded as in progress in Germany, the object of which is to ascertain whether the nerves, like other structures are not amenable to surgical treatment for their restoration after division and complete loss of function; but whilst the Germans are patiently experimenting to determine the point, it is my good fortune to be able to answer this question distinctly as the following case will show.

On May 5th, 1875, a patient named Adam Smith, a laborer, aged 22, entered the Infirmary at Leeds, under my care. He limped into the ward on crutches, his left lower limb being completely paralyzed and useless, and stated that he had come to request us to remove it, as an incumbrance. The story he told me concerning it was this. Nine months previously, as he was returning home one evening, at the close of his day's labor carrying his scythe over his shoulder, being anxious to make a short cut to his cottage, he attempted to climb over a fence; in doing this, the point of his scythe caught in the hedge behind him; he was jerked suddenly backward, and fell with the back of his thigh upon the sharp edge of the instrument. The result of this was a ghastly wound, the contracted cicatrix of which measured nine inches in length when I first saw it nine months afterwards. He lay bleeding profusely, where he fell for many hours before he was found and carried home; there the hemorrhage was staunched, the wound was dressed, and, in process of time, it slowly healed; but he noticed, during the whole time so occupied, that the limb was slowly wasting and withering away, and that it manifested no sign whatever of any returning sensibility.

Eventually, when he was able to leave his bed, he found to his

horror that, although the wound was healed and the limb was apparently saved, it had become wholly useless to him. So far as the distribution of the sciatic nerve was concerned, the power of sensation was entirely lost; of voluntary muscular power he had none, and the joints were relaxed and flaccid.

I need not detail to you all the efforts, vain efforts indeed, that he made to recover the lost power of the limb; suffice it to say that, receiving no benefit from anything he did or tried, he finally came to the hospital to ask for its removal.

The whole cause of this mischief was, of course, clear at a glance. The sciatic nerve had been divided, and, in the healing of the wound, the separated ends had never reunited. Here, if ever, was a fair opportunity to test the question. Are nerves which have been divided, and have for a long time remained disunited, capaable of restoration?

I called my colleagues to my assistance in forming an opinion on the matter. Dr. Clifford Allbut was good enough most patiently and carefully to test electrically the condition of the disused and wasted muscles, and he reported that, though not wholly destroyed, their irritability was well-nigh exhausted. My surgical colleagues agreed with me that whereas, should the attempt to restore the lost nerve-power altogether fail, I could still as a last resource, remove the limb, I should be justified in making an attempt to reunite the ends of the divided nerve. After fully explaining to the patient the position of affairs, and obtaining his assent, I determined to do so.

Having laid open the back of the thigh, and by a careful and deliberate dissection of the parts, exposed the wounded nerve, I found it completely cut across; the two ends were firmly felted in cicatricial tissue two inches apart. On the upper one was a large bulbous swelling, the lower appeared atrophied and somewhat wasted. Both were carefully loosened and detached; the bulb was removed from the upper one, and each was then pared obliquely until apparently fresh nerve tissue was exposed. When then I attempted to bring them together, the nerve was found to be so much shortened that I could not do so until I flexed the knee fully. This enabled me to make the ends of the nerves meet without strain; they were then carefully stitched together with very fine carbolized catgut thread,

the wound was closed, the ankle was firmly lashed to the buttock, and in this position the patient was put to bed.

I will not weary you with details. Suffice it to say that little by little, and in a very wandering fashion, day by day, and week after week, sensation was found to be returning in the limb. At the end of five weeks, I began slowly to relax the position and let the leg down inch by inch, until at length it became straight again, and then, to my intense satisfaction, I found that the restored sensibility remained. By very slow degrees, the power of voluntary motion also returned, and, on August 7th, he was discharged from the hospital so far cured that, with the help of two sticks, he was able to support himself on the limb and could walk. From that to this, he has gone on improving. During the whole of the past winter, he has worked in the fields as he was wont to do before his accident, requiring neither stick nor support nor help of any kind; and, though the limb remains greatly inferior in size and nutrition to the opposite one, it is, to all intents and purposes, a useful member again.

Since the performance of that operation, my colleague Mr. Atkinson has in similar manner successfully reunited a divided median, and Mr. Jessop has reminded me that, long prior to my case, he had also been equally happy in thus dealing with an ulnar nerve.—*British Med. Jour.*

DENTISTRY ON THE HORSE.

It is generally believed, even among the best horsemen in the country, that glanders is quite prevalent among horses. Many a valuable animal has been killed by direction of its owner because of an offensive discharge from the nostrils, which has been considered as a sure indication that the horse is affected with that dreaded disease, glanders. The fact is, cases of glanders are few and far between. C. D. House, the veterinary dentist, says

that in all his experience he has never known of but two cases, although he has known of hundreds of instances where horses have been killed because they were supposed to be affected with this disease. The whole trouble arises from neglect of the teeth.

Yesterday Mr. House operated upon the horses of the Hambletonian breeding stud, of Dr. Flagg, C. M. Dyer, Washburn & Vaugn and W. G. Strong, pulling or cutting, or filing the teeth of nearly every animal he examined. In one of the horses' mouths the wolf teeth were found to be entirely covered by the gum, and detached from the jaw, so that every time the bit was moved in the horse's mouth, these teeth were turned, crowded and jammed in the gum, of course causing the horse to jump and run. Another case was found where the grinders had been worn rough and uneven, and were slightly displaced, so that the horse in eating was continually grinding away upon the inner lining of the mouth, keeping it constantly raw and painful, and of course making the beast cross and irritable. Still another case was where one of a colt's temporary teeth, after being partially forced from its place by the second teeth, had remained fastened by one root and in such a position as to grind continually upon the gum while the animal was feeding, and yet so nicely had the decaying tooth been lodged that its presence was only detected by the offensive odor arising therefrom. Several cases of inflammation of the gums were found which were accounted for by the presence of tartar on the front teeth,, which was readily removed. Mr. House's operations yesterday were closely watched by a large number of horsemen, and many who were unable to account for sensitive mouths in their own horses became satisfied that the trouble was with their teeth.

The animals rather appear to like having their mouths worked upon, and Mr. House says he never had one attempt to bite him. He runs his hands and arms into their mouths freely, works away upon the sensitive parts without causing the horse to exhibit signs of pain or uneasiness.—*Worcester, Mass., Spy.*

Clinical Reports.

PHILADELPHIA DENTAL COLLEGE, DEPARTMENT OF ORAL SURGERY.

CLINICAL SERVICE OF PROF. J. E. GARRETSON, M. D.

Harelip.—The first case, gentlemen, to which I direct your attention is this of the infant lying upon the operating-table before you. As you will notice, the child has an imperfect upper lip, combined with a deforming projection of the intermaxillary bone. The imperfection of the little patient is congenital; that is, the baby was born in the condition in which we see it. Harelip, a term which well expresses the appearance of the part, gets its signification from the formation of the lip of the animal of that name, the lip of the hare being split or divided into two parts.

Harelip has not, however, always the expression of the case before us. Few surgical conditions differ more markedly. Double harelip is common; that is, the lip presents two breaks or divisions. Complicated harelip will frequently show itself to us; here the expression may be of any variety. A common condition of complicated harelip is absence of an intermaxillary bone. Another common condition is absence of a soft palate. Alveolar deficiencies, as relations, are so frequent as to be expected in all cases. Sometimes the lacking parts are to be seen hanging from the septum of the nose; sometimes they form a tumor of incongruous character and appearance lying in the labial gap. In fact, as no doubt I shall have many examples to show you during the winter, they are of every variety of expression, requiring for a proper treatment every variation on a common rule.

The child before us is three months old. I consider this age as the very best that is to be selected for the performance of an operation. At this age the plastic force is full of vigor; the child

feeds at the breast of the mother, being thus in communication with the very best of infantile carminatives; dentition has not yet commenced to worry and congest neighboring parts. Three months is not, however, what is to be termed the age of selection. I have done the operation here to be practiced, at all ages, from six weeks to thirty years. Some surgeons say a week old is a good time; some prefer a year old, some three years old. I will put it in a word, however, and say that you will assuredly find at the age of three months every advantage to be found at any other age.

Shall ether be given this child? Some surgeons say "not to a child so young." My experience differs from such. Only a week ago I kept a child six weeks of age under the effects of ether for nearly an hour. We will etherize this infant to complete anæsthesia, and keep it in that condition until through with the operation.

Paring for harelip is variously practiced. In the instance before us I will make one that is almost certain to avoid the ugly notch commonly seen. First dissecting away the lip from the gum to which you see it closely bound, I enter the knife nearest the nose and cut toward the free border of the part. I do not, however, cut through the border, but reaching it, the section made is allowed to fall, thus doubling the length of raw surface exposed, and giving for retention all, and much more, border tissue than can be used.* Even a happier method than the one now being practiced consists in making a lateral section from the face of one side of the lip and attaching to it a section brought from the opposite side. An objection which renders a practitioner timid about doing it is the possibility of non-union, in which case the patient is placed in a worse condition decidedly than previous to the attempt.

The pins held in my hand are made of steel, having bead heads. I use three of these, entering the first at the free border of the lip so as to be sure of a proper approximation. The second I put as near the nose as possible. The third is placed intermediate. Next, as you see, I draw gradually together the raw surfaces, using in the form of the figure eight over the pins

*A cut in the lecturer's "System of Oral Surgery, page 963, shows the method.

this coarse cotton thread. The thread, as I desire you to notice, is that kind used by the grocer to tie up his small packages. Such thread, or twine, is the best that can be employed; it is very soft, thickens itself by absorbing fluids, and does not tend to strangulate the part it overlies. The pins are to be removed in from one to four days as indicated. Every case, however, is in this respect a law to itself.

We will direct that ten drops of the camphorated tincture of opium be given the child; to be repeated, if found necessary, in the evening.

Case 2 is one of aphonia. When I request the little patient to speak you observe the great volitionary effort made in response. The word will come after a time, but it is a forced word. It costs this boy as much labor to move his larynx as it does a porter to carry his load. The lad, the father tells me, commenced to lose his voice some two years back. What is the matter with him? The way to find this out is to use the laryngoscope. We must see the inside of the organ in which resides speech. Taking advantage of the opportunity I will show you how a laryngoscopic examination is made, and while showing you this will tell you about different kinds of laryngoscopes.

The glass held in my hand you will term a dentist's mirror; that is exactly what it is. The originator of laryngoscopy is M. Leuret, a French accoucheur; his idea was derived from his dentist. The little glass held in my hand is really all of the instrument that has so big a name; all other arrangements are accessories. I will not only show to myself, but will show you, the larynx of this boy, and I will use nothing in the way of an instrument but this glass. You will say illumination is required. Well, for this there is every variety of apparatus, and there is, as well, the sun.

To-day I will use the sun. Placing the patient upon this reclining chair, having his head well thrown back, I place the open mouth, as you see, directly towards the light-rays streaming in such abundance through the skylight. Now with a napkin I catch the tongue, and drawing forward this organ, I direct the boy to speak the letter *a*. While he continues the effort to repeat this letter I introduce the glass, first warming it, carrying it gently into the fauces. I will aim first to show to the gentle-

man looking over my shoulder the epiglottis [the demonstration was repeated a number of times, very perfect views of the part being obtained]. I will next proceed in the search after a diagnosis. Already I have it. Let now some other members of the class come to my side and be shown what I have just seen with great clearness and satisfaction. It is a dull eye that does not catch at intervals sight of the two vocal cords lying almost motionless side by side. In the position and want of movement of these cords lies the diagnosis. The trouble with this lad is partial paralysis of the *chordæ vocales*. Another thing is to be observed. There is extensive granular inflammation of the mucous membrane; this, perhaps, has something to do with the lost motion in the cords. A few weeks back I operated in a case of loss of phonation, where the cause lay in a large tumor which had sprung from the sacculus, and filled almost completely both ventricles. To cure the case I had to perform thyrotomy—a very rarely-performed operation.

In the case of the present patient we will first prescribe for the condition of the throat; after curing this we will resort to the electric touch applied to the paralyzed cords. I have no doubt as to restoring the ability of free speech.

[In connection with the case a description was given of laryngoscopic inventions.]

CASE 4 is this colored man who comes to us from the clinic of a neighboring medical school bringing a diagnosis of abscess of antrum. Abscesses of any and all places have associated with them signs of an inflammation that has preceded the formation of pus—acute abscess I speak of. Healthier boundaries of an antrum I have never seen than are shown in the case before us. The last thing I should have thought of in the way of disease as it relates to this man would be abscess of the antrum. To trephine an antrum, however, nowadays, using the engine, is a matter neither of trouble nor risk. I propose to trephine this antrum out of regard for the judgment of the surgeon who sends the diaganosis. It will be a point of good gained for the patient to prove that no trouble of any kind exists in the cavity. If the diagnosis made be right, it will give a lesson to us of great importance, inasmuch as it will show that local dis-

ease can exist without external manifestations. [Antrum here trephined.]

No pus comes from the wound. No pus is in the cavity. Nothing is in the cavity. I turn the probe, as you see, with ease in all directions. By exclusion the antrum falls out of all further consideration of this case.

Something, however, very serious is the matter with the man. He is so weak as scarcely to be able to stand. To look at him you would say that his affliction, whatever it may prove to be, is not without danger.

I again take in my hand the long-stemmed mirror which a few minutes back I described to you as a laryngoscope. For the purpose which I now hold it, it has become a rhinoscope. The nostril adjacent to the cavity we have just opened is discharging an offensive mucus, it is swollen, it is angry-looking, it is so stopped up that no air is to be drawn through it; it is in every respect a bad-looking nostril.

I place the patient, with open mouth, before the streaming rays from the sky-light, and now, as you see, introduce the glass, reversed as to its former position, into the fauces. A little skill attained in the direction enables me to get a good view of the posterior nares. The parts look much worse behind than in front. I have no hesitation in pronouncing an opinion. The trouble is inflammation of the nasal lymphatic glands, which inflammation has passed to the stage of suppuration. Beneath the Schneiderian membrane the bistoury will reveal the existence of a good deal of pus.

[A curved bistoury was here thrust into the swollen membrane, the withdrawal being followed by a free flow of pus.]

The result, gentlemen, verifies the diagnosis. This is not all, however; a more important matter remains. Why did these glands inflame? There is phthisis of a gland as there is phthisis of a lung. The disease before us is consumption of glandular structure. In these glands has been deposited tubercle of the same kind found so destructive of lung tissue. When tubercule is deposited in glandular structure, we do not speak of its expressions as consumption; we call them scrofulous. The inflammation, then, that we have here, is scrofulous inflamma-

tion, and to permanently cure our patient we are to treat him for scrofulosis.

We order first daily attention to the local disease. Second, and most important, we direct free exercise in the open air conjoined with salt baths, to be taken each morning. The character of diet is important; the patient must live well. Rest is necessary; the man must be in bed every night by 9 o'clock. As medicines are concerned, we will put him at once on cod-liver oil and the phosphites. To lift him as quickly as possible from his present state of depression, we will prescribe pills of sulphate of quinia, 3 grains each, one to be taken thrice daily. For a few days it will be well for him to drink reasonably of eggnog.—*Dental Cosmos.*

Correspondence.

PALACE HOTEL, SAN FRANCISCO, July 12, 1878.

EDITOR MISSOURI DENTAL JOURNAL:

DEAR SIR:—By an accident to the City of Peking I am detained about two weeks here; consequently I have considerable time on my hands. I left St. Louis on the morning train, Kansas City and Northern railroad, June 20, 1878, for a tour around the world. A delightful ride through the abundant harvest fields of Missouri, Iowa and Nebraska. The weather was quite hot. Our first stoppage was at Ogden to visit Salt Lake city, which is very like any other city in a desert depending upon irrigation for an existence, though not so fine as Denver. The old tabernacle is not as large as I expected to see, and is not arranged for service at night or in cold weather. The new winter tabernacle, which is to be heated, and lighted by gas, will be completed this fall. The temple is about one-fourth compteted, I should judge, by the height of the walls, which are very massive, in places nine feet in thickness. Both buildings are of gray granite.

The work is being pushed forward by about forty of the faithful. Even the tomb of the late Brigham is a granite slab about four by eight feet square securely bedded down, on a level with the ground. Also his residence, the church office and library of records, publishing house, tithing house, and a few other of the peculiar institutions, all within a concrete wall about eight feet high. The Zion Co-operative Mercantile Institution is the biggest thing in the territory. All goods have Z. C. M. I. marked on them. Dr. Forbes' sons Gus. and John are connected with a large agricultural implement depot here. Dr. Chapman, dentist, of Illinois, is now in practice in Salt Lake city.

The trip over the alkali desert was very disagreeable, the scenery being chiefly sage brush. The scenery of the Sierra Nevadas is very bold and grand, the mountains being covered with pine forests. I spent about a week among the big trees and in the Yosemite valley, (for particulars see guide book) about ninety-five miles from Mercer Point, which is made by six-horse stages with relays ever, ten or twelve miles. The stages will seat from fifteen to twenty-two persons each, and the ride is interesting, though the most dusty trip I ever took The route passes through pine forests many miles in extent. Many of the trees are of a diameter simply enormous. Yellow, sugar and spruce pines eight feet in diameter, red cedar nearly as large and the red wood or (*segnoria gianticus*) grizzly giant, was the largest I saw, being about thirty feet in diameter and two hundred and thirty feet high. There are many others of less diameter but taller and more graceful. The cones from the big trees are abont two ana one-half inches in length, while the cones from other pines are from fifteen to twenty inches long. There are no small or medium trees.

Next come the manzaniate, a tree or bush that sheds its bark instead of its leaves, witch hazel, wild lilac and a variety of other shrubs. The flora is very varied and beautiful, one species in particular the snow plant (*sardode sangnineus*) or bloody flesh, and it is surely the bloodiest looking plant that I ever saw. The views from Inspection Point, Union Point, Glacier Point and Sentinel Dome, the latter, 4,125 feet above the valley, including mountains, waterfalls, rivers and lakes, though the amount of water at this time of the year is small, are sublimley grand.

I attended my first California law suit in the valley. The defendant made his defense before the plaintiff made his speech. The judge had a black eye received the night before in a fight. Court was held in the poker room of a saloon and the officers of the court were all drinking and nearly all tight. The judge delivered a verdict for the defendant and the prisoner was discharged before he polled the jury. In making the return to the railroad, within a few miles of Mercer, we passed through one wheat field ten thousand acres in extent. The crop was in splendid condition and was being harvested by one of the California headers, cutting sixteen feet in width. The grain was thrashed in the field.

San Francisco from a distance does not look prepossesing, but upon arriving as the Palace hotel, and having shaken off the dust and partaken of the edibles so generously and artistically set upon its board, one feels thankful for the generous impulse that prompted the palace of America.

Among the profession in San Francisco are Drs. S. W. Dennis, Younger, Mowbray. Dutch is out on his vacation, but is ably represented by Goe; Blake, Griswold, Winter and others who are all built upon the plan or scale of everything in California. Dr. Dennis has invented a pneumatic dental mallet which excels any electric, automatic or engine mallet yet produced.

The Chinese quarter, through Murderers Alley, the Tongwah men temple with eleven gods and goddesses, druggists, doctors offices, narrow, dark alleys, Barbara coast, female quarter, opium den, jewelry factory, barber shop, theatre and restaurant are interesting sights of the kind. For a quarter of a century experiment, the Chinese certainly have not proved very encouraging, because they carry out too practically the doctrine so prevalent in this State, make your momey but take it home to spend it. They are badly treated and by the lower classes often abused. These are the hasty jottings of my trip half across the continent.

Yours truly, WM. N. MORRISON.

[The delay in the appearance of the foregoing was occasioned by the change in the editorial management of THE JOURNAL. By some oversight the letter did not reach us until a few days ago.—ED.]

BROOKLYN, NEW YORK, November, 1878.

EDITOR MISSOURI DENTAL JOURNAL:

In the June number of the JOURNAL it is asked "if any one can tell when and by whom sulphuric acid was first used in treating necrosis."

The earliest mention of the use of sulphuric acid in treating caries and necrosis that has happened to fall under my notice is made by Dr. Lawrence Heister in his "System of Surgery" published at Nuremburg in 1718. Latin edition published at Helmstadt in 1739. English, London, 1742. After naming a number of the milder remedies used, he says, "Others apply corrosive medicines, as the aqua phagedænica, and spiritus vitrioli aut sulphuris, and with the same success. In the room of all these you may well substitute solutis mercurii in aqua forti vel spiriti nitri." Thus it is plain to be seen that the use of sulphuric acid in treating caries and necroses can hardly be said to be of recent date. Dr. Heister no where intimates that it was a *new* remedy when he wrote.

CHARLES D. COOK, M. D.

Editorial.

We wish to call the attention of our readers to the very valuable paper which this number contains, on hard rubber appliances for congenital cleft palate, by Dr. Thomas Brian Gunning, of New York. Dr. G. proposes a complete revolution in the construction of artifiicial palates, so far as the use of soft rubber is concerned. By the substitution of hard rubber for the more perishable material formerly considered necessary, the making of artificial palates is greatly simplifled and thus brought within the range of ordinary mechanical deutistry.

This number also contains a very interesting essay on the much discussed question of the position dentistry occupies, or is to occupy in the future, relatively to medicine, by Dr. C. Stod-

dard Smith. We regard Dr. Smith's paper as a strong preesntation of the views held by those who insist that dentistry is, and shall continue to be, an independent profession. We do not propose to attempt any discussion at this time, of the points contained in the paper, but commend it to the serious consideration of our readers.

In the proceedings of the Second District Dental Society, of New York, the use of the new felt foil was discussed. In addition to what is said of this new filling material in the report of the proceedings of that Society, we append an extract from a letter from a very intelligent dentist in the interior of Missouri. He says:

"I inclose a sheet of Slayton's Felt Foil. In my hands it is a failure, perhaps you may be able to work it with more success. A simple test shows that it contains mercury; in fact an amalgam. It fails to stand the tube test and the analine solution permeates the entire plug. At least this is my experience."

In the November number of the *Dental Cosmos*, the publisher of that journal calls "attention to the fact that each issue of the *Dental Cosmos* contains at least fifty-six pages of reading matter —more than any other dental journal published."

The statement is incorrect, evidently an oversight. The MISSOURI DENTAL JOURNAL, has, for more than a year, contained not less than sixty pages of reading matter in each number, and for the last few months, sixty-two pages in each issue. The publishers of this journal claim that *it* contains more pages of reading matter "than any other (monthly) dental journal published."

BROOKLYN DENTAL SOCIETY.

The Eleventh Annual Meeting of this society was held Oct. 14, 1878. The following officers were elected for the ensuing year.

President.—Dr. C. D Cook. *Vice-President.*—Dr. A. N. Chapman. *Recording Secretary.*—Dr. C. P. Crandell. *Corresponding Secretary.*—Dr. W. H. Atkinson. *Treasurer.*—Dr. W. A. Campbell. *Librarian.*—Dr. C. E. Mensch.

C. P. CRANDELL, Rec. Sec'y.

THE MISSOURI

DENTAL JOURNAL,

A MONTHLY RECORD OF DENTAL SCIENCE AND ART.

VOL. X.——DECEMBER, 1878.——No. 12.

DENTAL NEURALGIA.

BY G. V. BLACK, D. D. S., JACKSONVILLE, ILL.

Before proceeding to discuss that form of neuralgia which we designate as Dental Neuralgia, it will be well to briefly consider

NEURALGIA IN GENERAL.

Neuralgia is a term used to designate an affection characterized by pain, located in the trunks or branches of the sensory nerves, and unaccompanied by other symptoms. But little is known of its real nature. Post mortem examinations have usually revealed no organic lesion of the nerves involved; the changes, if any, not being of such a nature as to be demonstrable by our present means of examination. There can, however, be but little doubt that in the production of pain there is a molecular excitement, at least in the elements of the nerve itself, that differs essentially from that called into play by the conduction of impressions in the ordinary healthful way. The healthy conduction of impressions, of course, includes pain as well as tactile

impressions. The pain from a wound, or a simple inflammation of a sensitive part—as the tooth-pulp—is conducted to the sensorium in a perfectly healthy way by healthy nerves.

Some forms of neuralgia seem to consist of such a condition of the nerves, that the effort to convey sensation—perform their function—is painful, as the performance of the function of contraction is painful in an inflamed muscle. Other forms of the affection differ from this in that the nerves seem to convey normal sensation properly, and without excitation of pain. It is evident that the nerves are not only the seat of pain, but the seat of disease in many instances.

Neuralgia may be either primary or secondary, but is, perhaps, very generally secondary, and dependent upon some preceding or co-existent disease or lesion, and, therefore, symptomatic. No division into primary and secondary can be of any value, unless it can be shown that certain symptoms, or classes of symptoms, arise from definite causes, and thus afford a guide to treatment. It is probably best, with our present knowledge of the affection, to always consider it as dependent upon some pre-existent or co-existent malady. This malady or lesion may be of the most obscure character possible, and wholly escape our closest search; indeed, we may say that in a large proportion of cases no cause can be discovered.

The *Pain* in neuralgia is entirely peculiar to this affection, is essentially different in its character and course from that induced by other causes. We may have pain projected from the seat of an injury or inflammation, either in a centric or excentric direction, and yet not constitute neuralgia. We may often find pain projected along the arm, in case of whitlow. The entire arm may become painful; the elbow or the axilla may suffer from projected or sympathetic pain. These sympathetic pains occur from various causes, but are almost always accompanied by intense suffering at the seat of lesion. Certain affections of the teeth, as pericementitis, are liable to cause them about the angle of the jaws, throat, etc. The lymphatics are usually involved, and the glands become swollen.

Neuralgic pain is essentially different from these projected pains, and seems to have nothing in common with them. The pain is never steady, but presents well marked intermissions or

remissions and exacerbations; it is paroxysmal, the paroxysms follow each other in rapid succession, or the intervals may be much extended, even to days, presenting the utmost irregularity. It is usually a sharp, piercing pain, shooting along the course of the nerve, often with lightning-like speed, but sometimes changing its locality slowly, or possibly remaining stationary for a short time in one spot, or skipping about from point to point. We have seen patients in endeavoring to point out the immediate seat of pain, place the finger under the eye, on the chin, the angle of the jaw, the ear, the temple, etc., in rapid succession, and declare that the pain ceased in the first locality, and appeared in the second, and so on, only one point being painful at the same moment. Again, we have seen the course of the nerves accurately traced in following the pain, as it darted from point to point. Again, the pain may become at once intense along the course, or the portion of a course of a nerve trunk, and remain so for an indefinite time when it will remit or wholly intermit to be renewed after an indefinite time in exactly the same locality. The pain is usually described as sharp, lancinating, piercing, boring, tearing, burning, and the like. Very rarely do we hear patients complain of heavy, dull pain, except in the remission of the paroxysms.

The pain may be seated in the skin, and, therefore, superficial. In this case it is oftenest described as prickling, as though a thousand needles were pricking the flesh. Sometimes this is burning, as though each individual needle was red hot. The slightest causes are often sufficient to induce a paroxysm, as a breath of cold air, the hand passed over the part, or anything that may call upon the affected nerves to convey an impression —exercise their functions—which gives a striking resemblance to the pain induced by the contraction of an inflamed muscle. In other cases the paroxysms come and go without any apparent cause.

There is usually no special attendant constitutional symptoms farther than general debility as a result of continued suffering. The disease may, however, and as a fact, is often developed in connection with other diseases, especially such as slowly impair the vital powers, as scirrhus, etc.

In many cases, certain painful or tender spots make their ap-

pearance along the trunk of the nerve, or at the situation of the ganglia, which are found to be tender on pressure. These tender spots may or may not be the seat of pain. Our personal observation, however, is that they are found to be points from which the pain radiates in the beginning of paroxysms. They are often of diagnostic importance.

Local Anæsthesia is a frequent result of neuralgia; the nerves seeming to lose, temporarily, the power of conducting impressions. This is perhaps noticed oftenest when the pain affects the surface. In several instances we have seen these anæsthetic spots well marked about the face. We examined a case, recently, in which sensation was entirely lost in the region supplied by the nerves escaping from the mental foramen. Pulps of teeth which cause neuralgia are often found in a state of anæsthesia.

ETIOLOGY.

The causes of neuralgia may be divided into Predisposing and Exciting. Persons who may be predisposed to the affection may have it developed by a very trifling exciting cause, while with those who are not so predisposed, such causes may fail entirely to develop the affection.

PREDISPOSING CAUSES.

The Neuropathic predisposition, which has been minutely studied and established in late years, plays a very important part in the causation of many nervous diseases. By this phrase, says Dr. Erb,* "is understood a pathological constitution affecting the functional constitution of the nervous system, by virtue of which, those who are thus constituted manifest throughout life the most varied pathological symptoms in regard to sensory, motor and physical processes. No one has yet been able to show in what this peculiar anomaly consists, and while some console themselves with the hypothesis of delicate trophic disturbances, or modifications of molecular arrangement, without thereby getting any nearer the facts, we must rest satisfied that such constitutional Neuropathies really exist, and that they play an important part in the production of neuralgia. They may be congenital, or acquired, in consequence of various adverse influences. Many forms of neuralgia owe their origin to trans-

*Ziemssen's Encyclopædia.

mission from parent to offspring, which seems also true of many other nervous diseases, as chorea, hysteria, paralysis, etc."

Certain periods of life also have an influence in predisposing to neuralgia. It does not occur often in childhood, it seems to increase with increasing age. The sexual periods, as puberty, the menopausis, etc., seem also to exert an influence on the nervous system favorable to the development of the affection. Disturbances of nutrition also predispose to it. There is, perhaps, no more fruitful cause than anæmia, under the influence of which many distressing cases are developed.

All influences which tend slowly to depress the vital powers, such as overwork, too little sleep, close application to study, to the needle in the case of sewing women, confinement in illy-ventilated rooms, etc., favor the development of the affection.

EXCITING CAUSES.

The most prominent exciting causes of neuralgia are wounds, mechanical irritants, punctures, contusions, etc. The severest forms of neuralgia have occurred from these causes when they have affected the nerves directly, even if they have affected only a small branch of a sensory nerve. Irritants applied to a nerve, as a bit of glass, a brier, an exposed tooth pulp, etc., have been demonstrated to have been the exciting cause of widespread neuralgia, not confined to the injured nerve, or its trunk, but radiating to many others besides.

Many cases of neuralgia are also supposed to be due to some changes in the orifices in the bones through which they pass from their origin to their distribution—or to little ossific nodules or exostoses impinging upon the nerve trunks.

Malaria is also a frequent cause of the affection, giving rise to many very severe forms of the disease. It may act as a predisposing cause in connection with mechanical irritants, or as an exciting cause in connection with other predisposing causes. Very many exciting causes might be noted, but space forbids. Enough has been mentioned to illustrate tendencies from which judgments may be formed in special instances.

COURSE OF THE AFFECTION.

How certain conditions predispose to neuralgia is unknown. It is equally unknown as to how exciting causes act to develope

the affection. Yet inquiry as to the observed cause of observable phenomena will not be wholly unprofitable.

It is not common for the pain to be developed suddenly, as may be the cause with pain from an injury. An uncertain period of time is required for its development, during which slight pains may be felt in the part about to be attacked, which gradually increase in severity. A period of preparation or development seems to be an essential feature of the affection. This is true, no matter what the exciting cause may be. A brier lodged in the flesh with its point in a nerve branch will produce a pain of a normal kind, immediately upon its lodgment, but no sudden neuralgia. A neuralgia may be developed within a few days or a few weeks from the continued presence of the brier point. This is something essentially different from the normal pain accruing immediately upon its lodgment or the inflammation its presence may have excited.

We have, therefore, a development of conditions in the sensory nerves themselves that induces the pain in question and is necessary to its production. As before remarked, we may call it by this name or that, without arriving at any better understanding of the subject. It seems certain, however, that some change is induced that gives rise to abnormal nerve function, the essential feature of which is pain; we may, therefore, designate this as the neuralgic condition of the nerves. This condition may be developed in, and effect only, a single branch of a sensory nerve, or it may at once be developed in all the branches of a common nerve trunk, or in a given region, or simultaneously in a large portion of the body. It may also first be enveloped in a single branch, or two or more branches, and then pass successively to other branches of a common nerve trunk, and then, as if by radiation from nerve center eccentrically, make its appearance in other nerve trunks in the neighborhood, and occasionally in distant regions of the body. In many instances there would seem to be little room for doubt that the spread of the affection is by propagation of the neuralgic condition along the branches and trunks of the nerves in a direction from periphery to center, and the reverse. As a rule, the affection does not present a continuous progression, but, after making more or less advance, becomes stationary, fre-

quently only extending to certain trunks and its branches; or the pain may be confined to the trunk, or certain portions of the trunk of the nerve. In that case, the pain does not appear superficially, but darts along, or is stationary, in the course of the affected portion of the nerve, as is often the case in sciatica.

The duration of the affection is exceedingly indefinite. It may continue for a lifetime, in spite of the most skillful treatment, or it may disappear within a few days. Generally, if a direct exciting cause is found and removed, the affection disappears in a very short time, if not immediately.

DENTAL NEURALGIA.

Under the term Dental Neuralgia. we include those cases of neuralgia the direct exciting causes of which are to be found in affections of the teeth. There is no longer any doubt that neuralgia of the fifth pair frequently has its origin in diseased conditions of the teeth, as the direct exciting cause. It therefore only remains for us to point out those conditions under which this result is most likely to occur, and if possible to indicate those forms of the affection thus developed.

Of course any exciting cause of neuralgia is most liable to develop the affection in those constitutionally predisposed to it, or who have become temporarily so from any cause, as miasma, anæmia, overwork, etc. This being understood, we may proceed to discuss those conditions of the teeth tending to its development.

We should say in the beginning that neuralgia must not be confounded with those cases of toothache in which sympathetic pain is projected to teeth more or less distant from seat of lesion, thus causing confusion in the patient's mind as to the particular tooth which causes the trouble. These we regard as cases of confusion of the sensorium in referring the pain accurately to its proper location, so that pain in a lower molar is referred to an upper, or the reverse. Again, pain in a molar may be referred to several of the adjoining teeth, as if neighboring nerve filaments had come to the aid of, and had taken upon themselves a portion of the burden of their fellow who was struggling under a load too heavy to be borne. In these cases the pain, although it may radiate to different parts of the face, is referred

to the teeth as the part subjected to injury, and does not, necessarily, involve a neuralgic affection of the nerves, and usually differs essentially in its character from that affection.

At the same time, we must not forget that neuralgia arising from causes entirely occult, referred to the distribution of the fifth pair, may be felt especially in the teeth, while these organs may, in themselves, be in a perfectly healthy condition. The extraction of teeth, under such circumstances, would afford no relief, farther than temporary abatement of pain arising from the shock of the operation.

Miss T., a teacher, applied to me February, 1872, on account of neuralgia, of which she said the central point of pain was the right superior molar. In tracing the course of the radiation of the pain, she traced the second division of the fifth pair, and that only. The molar tooth, and a point below the orbit—deep seated—were the especial points of pain. We noticed that in pointing out the course and seat of pain, she avoided touching the face. On brushing our fingers lightly across the face, a paroxysm of pain at once occurred.

Here were two points that very clearly contra-indicated a dental origin of the affection. 1st, It had been in progress for six weeks, and only the second divison of the fifth pair was involved. In every case of demonstrated dental neuralgia that we have, the second and third divisions have been at once or very quickly involved. 2d. The act of conduction of sensation from the surface induced a paroxysm, which we have never seen in dental neuralgia.

The tooth in question had a very large gold filling in the grinding and mesial surfaces, which we had placed there four years before, after removing the pulp. It showed no sign, whatever, of pericemental disease. The patient was evidently suffering from overwork and anæmia. We advised rest and a tonic course of treatment, both of which were practically disregarded. The patient was anxious to have the tooth out, which we refused, fully believing it would be of no benefit. The case grew rapidly worse, and extended over a considerable part of the body, becoming bilateral. She was forced to leave her duties, and resolved to have the tooth out. She applied to another operator and had it removed. The case continued to grow worse. After

exhausting her physician, she was advised, as she afterwards expressed it to me, "to go to the mountains and go wild in the woods," which she said she accomplished to the letter in a double sense; wild with pain and wild in the mountains. After two years of suffering, she slowly improved and was restored to her former health.

Dental Neuralgia we believe to arise from, and to be symptomatic of certain lesions of the dental pulp. So far as we have personally observed, it makes its appearance first in the fifth pair, and uniformly affects some portion of both the second and third divisions. From these it may extend to the first division, to the nerves of the neck and chest, and to the brachial plexus and upper arm. It seems never to appear superficially on the skin, but is always deep-seated, seemingly confined to the nerve trunks and principal branches—otherwise it does not differ especially, from neuralgia of the fifth pair from other causes.

The affection is never developed directly from acute inflammation of the tooth-pulp. In this condition pain may be radiated to neighboring parts, the same as sympathetic pains may arise in the neighborhood of other inflammations. How much this may have to do with the final development of neuralgia in those predisposed to it, is uncertain. Our own observation is, that very few sharp, active inflammations of the tooth-pulp degenerate into neuralgia, yet we have seen examples where this seems to have been the case. In all such, the inflammation has first become chronic and the local pain mostly or entirely abated before the occurrence of prominent neuralgic symptoms. As a rule, hyperæsthesia of the pulp precedes the occurrence of the affection, and it has generally been noticed by the patient that a certain tooth has been sensitive to thermal changes for sometime previous to the attack, and perhaps for a time after the development of the affection. This usually gives way, gradually, to an anæsthetic condition of the pulp. In very many cases that we have examined, however, no such previous or accompanying hyperæsthesia could be discovered, the patient being positive that there had been no abnormal sensitiveness of the teeth. In such cases it is rare to find the offending tooth in the front, or in an exposed part of the mouth. A common situation in such instances in which to find the exciting cause is in a second

molar or wisdom tooth, with a buccal decay about the margins of the gums, with a fungous growth of gum growing into and filling the cavity of decay, very effectually protecting the exposed pulp from external influences. From these circumstances, we are convinced that hyperæsthesia of the pulp is always a forerunner of neuralgia, but it is not necessarily great, and may often escape the notice of the patient, provided the cavity be occluded and in the posterior part of the mouth. By far the larger portion of dental neuralgias arise from exposure of the pulp in protected situations, where it remains uninjured by foreign bodies, and vitiated secretions are retained in contact with it. It seems likely that this circumstance is in part necessary to the changes which must occur in the pulp as a step in the initiation of that nerve change which must begin at this point and proceed thence along the branches and trunks of the nerves, in order to develope the affection. Such teeth are not usually sore to the touch, nor to rapping with an instrument. This may, in some instances, excite a paroxysm of neuralgia, but our observation induces us to believe that this is rare. Therefore, we consider this test, so much relied on by physicians, and so often reported in medical writings, as wholly unreliable in proving or disproving the dental origin of the affection.

After a few days' existence of neuralgia, if such a pulp be touched with an instrument, it will be found sensitive, perhaps abnormally so, and a paroxyism of pain will generally follow the experiment. But if the neuralgia has been in existence for several weeks and has been severe, the pulp may be found in a state of complete anæthesia, yet a neuralgic paroxysm is likely to follow within a few minutes after a puncture. How long a pulp may remain in this condition and yet retain its vitality, is unknown, and is probably very indefinite. We have seen several cases in which it had existed three months and one in which we have reason to believe it had existed more than six months, during all of which time the paroxysms had been frequent and very severe. We will relate the case:

April 20th, 1871, Mrs. L. N., aged about thirty, married, applied for removal of second right superior bicuspid, which was very much decayed, being directed by her physician to have it out, on account of neuralgia. She gave the following history:

About six months ago she had some difficulty with her teeth, and as the molars and first bicuspid on this side were badly decayed, she had them removed. The second bicuspid was also much decayed, but she intended to have it filled, but had neglected it. She had had no more trouble with her teeth, but continued to have occasional paroxysms of neuralgia, in both upper and lower jaw, which increased in frequency and severity, and gradually extended to temple and brow, and to the orbit; and also had severe earache. Within about six weeks the pain extended down the side of the neck, and finally to the chest, afterwards to the upper arm. It had been so severe in this latter position that she could not use her arm well. She had had no superficial pain at any time; no prickling or loss of sensation in the skin. The patient was very pale; decidedly anæmic, and seemed in a very weak condition of body. Stated that her health had been good before, though she was not robust.

Examination of the bicuspid tooth showed a large decay in mesial surface, pulp dead, peridental membrane healthy. A decay was discovered in the cuspid, mesial surface, with opening into pulp, which seemed insensible, but bled on being touched with the excavator.

We proposed the removal of this pulp, to which patient objected, saying she had been sent to have the bicuspid removed. This we refused, and referred her back to her physician with statement of the result of our examination. 21st. Patient returned. While opening the pulp chamber for removal of pulp, a very severe paroxysm of pain occurred throughout the affected parts. Arsenic was applied. 23d. Reported very severe suffering for several hours after application. 24th. Better, but objected to having pulp removed, feared another paroxysm. As there were no signs of soreness, it was deferred until next day. 25th. Removed pulp without exciting pain. No paroxysm had occurred for twenty-four hours. Patient rapidly recovered her usual health.

In another case: a woman aged about twenty-five, unmarried, a seamstress, before in apparent good health, came to me with neuralgia that had proved intractable for three months. The history of the case showed the affection to have made its appearance in the third division of the fifth pair, pain quickly involving

the second, and more gradually spreading to other nerves, until the branches of the fifth, the side of the neck and chest were involved, but not the arm. There was in this case considerable mammary pain, which, however, had been the last locality in which pain had been developed.

The cause of the difficulty was found in a lower molar, the pulp of which I had capped with oxychloride of zinc and filled, some weeks before the occurrence of the neuralgia. The pulp was at once removed by the broach. In itself it did not seem sensitive, but a severe paroxysm of neuralgia followed. Within a week the paroxysm disappeared, but the anæmic headache, a severe pain in the top of the head, persisted.

We saw the patient no more, but learned that malposition of the womb occurred during this anæmic state, and chronic metritis was developed, from which the patient made a tedious and imperfect recovery.

These cases will usually, if the neuralgic predisposition be not very decided, be relieved by the destruction of the irritated tooth-pulp, or removal of the tooth, without other treatment. Spontaneous death of the pulp is attended with a like result.

The cases we have recited have been the worst forms we have met with. Cases of such duration, we are persuaded, are not very common, nor is there any necessity for their duration, if the cause be recognized. Most of the cases we have met with, have been of only short duration. That some of these would have been as bad as those related, if the cause had not be recognized, we have every reason to believe.

PATHOLOGICAL CONDITION OF PULP.

In such cases the condition of the pulp, as before remarked, is never that of active inflammation. In the cases where we have minutely examined the pulp we should explain it, first, as a destructive hyperæmia; there is an abnormal amount of blood, without, as a rule, much hyperæsthesia, and second, what is of importance as showing the tendency of this diseased action, the dentinal fibrils have lost their sensibility, as shown by the entire absence of sensibility on cutting into the dentine. We have examined no well-marked case of neuralgia from the tooth-pulp where this was not the case. Third, there is often found a

marked disposition to destructive ulceration of the pulp. The exposed surface in this case is usually covered with pus; this condition, as is the case with most others recited, may often be met with where there is no neuralgia. Fourth, minute abscesses or pockets of pus are frequently found within the substance of the pulp. We have frequently discharged a minute drop of pure pus from a pulp, and in a few instances have repeated this several times at intervals of a few days. Fifth, the pulp may be a little reddened, a natural color, or even ashy in appearance, not giving much evidence of disease by ordinary examination. When we have been able to remove and make microscopical examination at once, the tissues have been literally packed with wandering cells or leucocites. The number of these cells that may be present in the tissue without appearing distinctly as pus, has greatly surprised me, and leads to the inference that this is essentially the condition of the pulp in all these cases of which the phases before described are modifications. How this may be we are not prepared to state, as this is a matter of recent observation. In two instances we have been able for a few minutes to see distinctly the motions of these cells as they crept, amœba like, through the tissues. This is a matter of great interest to the Pathologist and the Microscopist, and we hope others will make observations. It seems likely that there is a tissue condition in which it becomes crowded with wandering cells to the extent, perhaps, of considerable swelling, without, or almost without, the other phenomena of inflammation.

PERICEMÉNTUM.

Our observation leads us to believe that neuralgia is never induced by pulpless teeth or pulpless roots. We are perfectly aware that many reports may be found both in dental and medical literature, that would seem adverse to this opinion. But in closely scanning these reports we do not find that the conditions of such roots have been reported with such accuracy as would be necessary to establish the hypothesis that the neuralgia was a result of pericemental irritation.

Most of them are absolutely silent as to any definite examination that would determine whether or not a living pulp was present, and are, therefore, worthless so far as this point is concerned.

We have never yet seen a case of neuralgia that could clearly be referred to, or was relieved by the removal of, pulpless roots or pulpless teeth. We have, however, met with a case that would doubtless have been so considered, if the examination had been less rigid. This was a first inferior molar—crown gone and an abscess at the anterior root discharging upon the gum. The broach revealed a living pulp in the posterior root, which bled freely, and the puncture of which was followed by a paroxysm of pain.

As to why peridental inflammation should fail to induce neuralgia while such symptoms are induced by pulpal irritations, we have no theory to offer. This opinion rests entirely upon observed facts. This class of irritations begets another class of phenomena, which we may call projected sensations, or sympathetic pain, in various regions, which are always co-existent with pain at the seat of disease. They are usually accompanied by disturbances of the lymphatics, and the glands are often swollen and painful, which is rarely an accompaniment of pulpalgia or neuralgia.

CALCIFIC NODULES.

What the influence of calcific nodules in the pulps may be in exciting neuralgia is difficult to determine. Our own observation would be against the production of neuralgia from this cause. But that the sharp corners thus formed may serve to perpetuate irritations aroused by other causes scarcely admits of a doubt.

EXOSTOSIS.

Exostosis of the roots of the teeth, or more properly, hypertrophy of the cementum, is undoubtedly an occasional cause of neuralgia of the fifth pair, but we are persuaded that it is of rare occurrence; we have never met with but one case that could be referred to this cause. This we had under observation more or less closely for more than a year. The pain was felt mostly in the lower jaw, but the ear, a location deep-seated under the eye, and the malar prominence were often referred to as painful. Before the case came under our observation, most of the teeth on that side in the lower jaw had been removed in the vain attempt to cure the trouble, but without effect. We finally suspected a superior molar that had protruded from loss of its antagonist.

Upon removing it the roots were found largely exostosed—tooth otherwise healthy. Complete and permanent cessation of the neuralgia, within a week, which had been of five years' duration, justifies the opinion that the exostosis was the cause.

Quite a number of reports of neuralgia from this cause are found in our literature. We know of no distinctive feature that can serve us in arriving at a diagnosis.

ALVEOLAR ABSCESS.

Neuralgia from the burrowing of an alveolar abscess into the inferior dental foramen is an occasional occurrence. This is generally met with in the chronic form of abscess, and in the two cases coming under observation, the region supplied by the nerves escaping from the mental foramen, and the anterior teeth, have been the seat of pain. In such cases the presence of a tumor or a fistulous opening on the face, or more generally beneath the maxilla, will point unerringly to the source of the mischief. One of our cases was rather interesting. Mr. Geo. A. applied to me with neuralgia of the chin and lip on the right side, which had recently appeared also in the anterior teeth. Patient stated that it had troubled him more or less for eight or nine years, but he was frequently free from it for several months at a time. The paroxysms were sometimes severe, but on the whole it would not be considered a severe case. Examination of the mouth revealed a row of perfect teeth upon the lower jaw of this side, except that the first molar was gone. The gums, at the point where it was removed, appeared healthy. A partially cicatrized fistula was found under the maxilla, about midway between the mental foramen and the angle. A probe started into this was carried forward and upward, directly through the bone until it almost reached the gum where the tooth had been removed. The gums were dissected away, and the bone cut into with a chisel—it was but a shell—disclosing a cavity in which was found a root of the missing molar, and some fragments of necrosed bone.

We should have stated that the missing molar had been removed eight years before for the cure of this fistula, which, having failed, other means also failing, the condition had come to be considered by the patient as incurable.

Crowding of Teeth and impacted teeth, may possibly cause neuralgia by causing compression of the dental nerves in their bony canals. We know of no means of recognizing a cause of this nature. Examinations of each individual case must be conducted by the judgment of the operator, and the relations of the teeth studied. The position of impacted teeth should be made out as nearly as practicable, in order that their influence may be estimated. We are unable to give any estimate as to the frequency that these have been demonstrated to have been the cause of neuralgia. The cases that have already found their way into our literature have generally been too indefinitely reported to serve as a basis for conclusions. We have never seen a case that we could clearly attribute to impacted teeth, and but few where crowding of the teeth seemed to act as a cause, and these were not very clearly made out.

DISCUSSIONS.

Dr. Crouse:—The main point the essayist makes is that in all cases of neuralgia in the mouth, the pulp is in a state of anæsthesia—devoid of sensibility—he says, that you get a paroxysm of pain directly when you touch the pulp. I want to ask Dr. Black how far into the substance of the pulp he passes his broach before getting this paroxysm of pain, and why he terms it in a state of anæsthesia. We have all seen pulps that are partially void of sensibility, from long exposure or other causes, but I should call them in a state of death, or so nearly dead as not to be able to give off acute sensibility. Do such pulps come to life again, or can they be restored to a condition where they produce acute sensation? I have never seen such a pulp restored to health. In the cases where, on the removal of the pulp, he got a paroxysm of pain, and there is no further recurrence of it, I should say the pain was caused by the breaking off of the connection of the dead pulp from where it was alive. The gases from the dead portions of the pulp many times cause the neuralgia. If he admits that pulps which are partially devoid of sensation are in a dying condition, I take exception to his calling them in a state of anæsthesia. I understood him to say he had never seen a case of neuralgia where the pulp was gone, yet cites cases of abscess where he had complete neuralgia. I have hunted

all over the mouth for neuralgia, and have by and by found a little root in which there was not a sign of pulp, that caused all the trouble. It is my opinion that we may have neuralgia from a dead root. He speaks of removing drops of perfectly formed pus from the substance of the pulp. I think that he has not, in such a case, a very healthy pulp. Perhaps the pulp in one root was dead, and the pus may have come from it. I would like to inquire if the pulp was otherwise healthy.

One very positive cause of neuralgia is ossification of the pulp, the ossific matter impinging on the nerve in the pulp cavity.

I have had two or three cases where nothing but extraction of the teeth effected a cure, and have always found exostosis of the root in connection with calcification of the pulp.

I had a case recently where the patient suffered for years, and on removing the upper teeth all the roots were largely exostosed. There has been no more trouble with neuralgia.

Dr. Townsend, Pontiac:—Had a very severe case of neuralgia, three years ago, which continued for several years. The lower teeth were badly decayed. Removed five or six of them, and obtained complete relief. Also had another case, in which he removed two sound teeth, and one other. He split the teeth open, and found calcific nodules in all of them. The patient had suffered severely, but was entirely relieved by the operation.

Dr. Brophy:—There is one more cause of neuralgia which the paper did not mention, viz.: imbedded teeth. The severest case ever seen by the speaker resulted from that cause.

The patient, with severe pain located upon the left side of face, called upon a surgeon for treatment, who said it was a tumor, and advised its removal. An operation was commenced and discontinued, the surgeon believing it was something he did not understand; he sent the patient East. The patient was there under the care of an eminent surgeon, who opened the antrum, but failed to give relief. He prescribed quinine and iron. Finally she called upon a surgeon in Chicago, who pronounced it imbedded teeth. At twenty years of age she had had all her teeth removed, and remembered that two teeth were then absent. The surgeon explored, operated and removed a biscupid tooth. About three months afterward the pain returned on the other side, and another tooth was removed. The teeth were perfect.

Speaks of this because it is a common cause when the tooth is absent, and if any serious trouble arises it is well to suspect something of that kind.

Teeth, the canals of which contain pulp nodules, sometimes become slightly elongated and very sensitive to the touch and quick changes of temperature, so that this is another means of diagnosis.

There is another cause of neuralgia, which is spiculæ of bone, which sometimes remain a long time after extraction of teeth, and cause pain, but they are easily discovered.

Dr. Black:—Wanted to say a word about anæsthesia of the pulp. Supposed the gentlemen was not in earnest when he said the paper was describing a healthy pulp,—it was speaking of pathological conditions. Among those who make treatment of neuralgia a business, anæsthesia is one of the symptoms. He saw a case only a month ago in which there were a dozen places on the body of the patient entirely insensible. These things are common in severe cases of neuralgia. These pulps are not devitalized. They are in the process of destruction, but are not dead. They are in such a condition that the nerves cannot conduct sensibility in the normal way.

Question.—Can you detect any pulsations in these pulps?

Dr. Black:—Hardly ever. Now, about that little drop of pus. He takes a delicate instrument and pricks a pulp, and something oozes out, which he finds by microscopic examination to be pus. He did this five different times with one pulp, and then destroyed it with arsenic. He did not attempt to give these cases other treatment than removal of cause.

Dr. Talbot:—Filled a wisdom tooth for a lady three years ago, and found an exposed pulp, which he capped, and filled with amalgam. The first of February she came to him with a fearful neuralgia in the right side of the face; he removed the filling and found the pulp perfectly healthy. He did not see her again until a week ago, and she had suffered all the time. An abscess had formed at the apex of the canine, the root of which had been previously filled, and was about three months in formation. This is a clear case of neuralgia from a pulpless tooth. There is another point. Where a tooth has been aching for two or three days, he always makes an application of creosote or chloroform

to reduce the inflammation, and then have the patient return and make the application of arsenic.

Dr. J. A. W. Davis:—asked if nodules are invariably the cause of pain, and what are their symptoms?

Dr. Crouse:—We cannot diagnose them easily. There are no very distinct symptoms. Teeth with nodules in pulps are sensitive to heat and cold; generally some periostitis accompanies these cases. The pain is sharp, but not so severe as acute toothache from an exposed pulp. Must conclude we have calcification of pulp if the symptoms and examinations fail to make it any other trouble, or when we have looked for every other form of disease and do not find any. By drilling into the pulp we can find out how correct our diagnosis is.

Dr. Townsend:—Had a case some years ago of very severe neuralgia in the lower jaw. He concluded it was calcification, and drilled into the tooth and found the pulp was entirely calcified.

Dr. Brophy:—Removed several roots not long ago, and found some enlarged spots near the apex of each of them. There were no pulps, and patient suffered intensely from neuralgia. There was no doubt that this was neuralgia resulting from pulpless roots. Has removed many nodules in canals, and relieved the pain.

Dr. Black:—Their being pulpless is an accident of the case. You perhaps have read Dr. ——— case of neuralgia; he removed tooth after tooth, and then the patient suffered from the pressure of the plate. We must be careful or we will extract teeth in vain. Have seen mouths where teeth have been removed for neuralgia without curing it.

Dr. J. A. W. Davis:—Has a patient for whom he has extracted nine teeth for neuralgia. She is sixty-nine years old, and now she still has pain just as severe as before.—*Trans. Ill. State Dental Society.*

SURGERY OF THE FACE.

BY FRANCIS MASON, F. R. C. S.

A Lecture on Non-Congenital Deformities of the Face, Delivered at the Medical Society of London, February, 1878.

PLASTIC OPERATIONS ON THE FACE.

There is perhaps no department in surgery that has received more attention than plastic operations of the face, and as every case must be judged on its own merits, no exact or fixed rule can be laid down as applicable to all.

With regard to such operations, it will be well to consider them as two distinct classes: (1) Those that are undertaken for disease, and to remedy deformities necessarily occasioned by the surgeon in removing epitheliomatous or other growths; and (2) those that are undertaken to improve deformities occasioned by accidents, such as burns, gunshot injuries, etc.

Respecting the upper and lower lips much may be done without resorting to the transplantation of skin. The soft parts of the face are so mobile that with proper precautions they may be stretched to almost any extent, the one point necessary being that the soft structures should be thoroughly separated from the subjacent bone; hence some surgeons, Mr. Furneaux Jordan amongst the number, speak confidently of making a mouth with one lip, either upper or lower.

THE FORMATION OF A NEW UPPER LIP.

Various plans have been suggested and practiced to form a new upper lip. Thus Bérard made two parallel and almost vertical incisions, so as to include a portion of the skin of the cheek on each side of the nose, and, bringing the flaps downwards, united them in the middle line. Sédillot dissected a square portion of skin from each cheek, and united the parts in the center. Dieffenbach made an S-shaped incision on each side of the

alæ of the nose, and, detaching the flaps, brought them down to the median line. And the late Mr. Teale, of Leeds, in operating for the restoration of the upper lip after burns, made "a crucial incision, having its point of intersection immediately below the septum of the nose." In a case of severe burn of the face which was recently under my care, and in which there was great eversion of the upper lip, I made a V-shaped incision through the whole thickness of the lip, leaving the prolabium; the edges were then brought down, and thus, when the parts were united, the incision assumed the form of a Y. I referred to this patient in my last lecture.

RESTORATION OF THE LOWER LIP.

In remedying deformities of the lower lip after removal of disease, Buchanan's operation, which was first performed by that surgeon May 20th, 1855, is sufficiently well known to you to require no comment from me.

Chopart operated thus: He made a vertical cut from the free edge of the lip on each side of the disease, and carried the incision under the chin. The quadrilateral flap is dissected off from above downwards. A tranverse incision is then made below the disease, and the remaining portions brought up to the free edge of the lips.

For extreme deformities of the lower lip from burns I believe the best kind of operation is that designed by the late Mr. Teale; and as you are doubtless familiar with the details of that operations, I need not occupy time by describing it. In relation to this subject I may be permitted to refer to a case that was under my observation, in which there was great deformity of the face, neck and chest, with a gradual and daily increasing dragging down of the lower lip. In this example I performed an operation known as *autoplastie par glissement*. Two bridges of skin were raised on each side, and brought together in the median line. The details of the operation are fully reported in the St. Thomas' Hospital Reports for 1872.

RESTORATION OF MOUTH.

In injuries, as from burns, the mouth is sometimes so contracted as to be a great discomfort to the patient. Some years ago I operated on a girl with a singularly contracted mouth, in

the following manner: I passed a wire through the cheek, about half an inch from each angle of the mouth, and allowed it to remain until a permanent hole was established. When the hole had quite healed, I introduced a knife through the aperture, and divided the soft structures into the mouth, and stitched the mucous and cutaneous surfaces together. Mr. Husband, of York, refers to a case of much the same kind that was under his care. The patient was a young man, aged nineteen, who was severely burnt when he was six months old. The mouth was all but closed.

RESTORATION OF THE NOSE.

When the whole or greater part of the nose has had to be restored, the surgeon may select one of three methods: 1st, the French method of taking a flap or flaps of skin from the face; 2d, the Indian method, which consists in taking a flap of skin from the forehead; or 3d, he may choose the Italian or Taliacotian operation.

I will now speak of these methods categorically; and first, with regard to restoring deformities of the nose by the French method (*la méthode par déplacement*). M. Serres, in forming a new nose, recommends that the skin should be freely separated on either side, and each portion lifted towards the median line; or the incisions may be extended laterally into the cheek, as recommended by M. Labat.

The Indian or Koonan operation is stated to have been introduced to the notice of European surgeons by our countryman, a Mr. Lucas, since which it has been employed by Carpue, Travers, Liston, and other surgeons. Dieffenbach, who was a master of rhinoplastic as, indeed, in every other department of surgery, gives several practical hints as to the performance of the operation, which are embodied in a paper on this subject in *The Lancet* for 1835.

Dr. Lichtenberg and our honorary Secretary, Mr. Astley Bloxam, have shown themselves assiduous workers in this department of surgical science. And I may be permitted to refer to a case that was under my own care at the Westminster Hospital in 1871, in which I performed what may be termed a mixed method, and which I have never seen practiced. Three flaps were taken, two from the cheek and one from over the nasal

bones. These flaps were raised and turned inwards and downwards respectively. A portion of skin was then raised from the forehead, and being twisted at its pedicle, its raw surface was applied to the other three raw surfaces. The parts were stitched together, and the patient made a good recovery. I may add that in this case, when the wound of the forehead was granulating, I took a piece of skin the size of a shilling from the patient's arm and transferred it to the granulating surface with marked benefit to his personal appearance. I regret that, from circumstances beyond my control, I could not secure a photograph after the operation, but the case when under treatment was sufficiently well known, both at the Westminster and St. Thomas' Hospital.

Respecting the third method, or the Taliacotian operation, Alexander Benedictus, a Veronese, of Padua, appears to have been the first to write on this subject in 1495, and thus describes the operation, which was really much the same as that practiced by Taliocotius. The operator dissected the upper skin of the arm with a razor, and then, paring off the remaining edges of the nostrils, or, if necessary, cutting them away, he bound the arm to the head, in order that wound might adhere to wound. After this, the wounds having conglutinated, he separated from the arm with the knife as much as was wanted for the restoration of the nose. He adds, however, that these artificial noses badly endure a severe winter, and he recommends his patients to use them gently, lest they be torn from the trunk. Those who are interested in this subject will be glad to know that we are fortunate enough to have in our library a copy of Taliacotius' work, which was published in 1597. The Taliacotian operation seems almost to have died with its supposed author, for in the medical journals I do not remember to have met with a single instance (with one exception, and this was to restore the lip), in which this operation has been published. Of course they may have escaped my notice, but I have not unfrequently met with cases described as the Taliacotian operation, but which on reading have turned out to be the Indian method. My colleague, Mr. MacCormac, has performed the Taliacotian operation in two instances. Once on a girl, aged 16, on February 12, 1877, whose case has been fully reported in the Transactions of the Clinical Society. The deformity was occasioned by sloughing after in-

jecting a nævus at the root of the nose with the pernitrate of iron.

As to the result of these operations, there is one point to which I may refer, and that is the peculiar bloodless appearance of the newly-formed nose. Perhaps this may to some extent be remedied by tattooing the part, as practiced by Prof. Schuh, of Vienna. He employed it in the case of a young girl whose upper lip was formed from the skin of her arm, and which in eighteen months had not gained the normal redness of the lips. The operation consisted of taking from ten to twenty needles, each surrounded with silk, and united into a bundle. They were dipped into a liquid of vermilion, and pricked into the lip until it took a natural color.

EYELIDS.

I need say little respecting the plastic surgery of the eyelids, for the deformities occasioned either by disease or injury in this region must be treated on their respective merits, and most of the operations are described in works on ophthamology. I may, however, refer to a case of epithelioma involving the lower eyelid in which I removed the disease by a V-shaped incision. A flap of healthy skin was then detached and twisted on its pedicle, which became a very good substitute for the part taken away.

Again, in another case of severe ectropium after a burn, in a woman who was recently under my care at St. Thomas' Hospital, I performed the following operation: A V-shaped incision was made under the eye, and a flap of skin, being taken from the cheek, was twisted on its pedicle and inserted into the wound. I performed a somewhat similar operation to improve the less marked ectropium in the upper lid, but a portion of the flap which I took from the forehead sloughed. There was, however, nevertheless, some slight improvement. The case was not a favorable one for operation, inasmuch as the whole of the face was a mass of cicatrix.

And now, sir, although I confess I have experienced a natural anxiety in the preparation of these short lectures, I nevertheless regret, for many reasons, that I have to bring them to a conclusion. The surgery of the face is without limit, for it includes almost the whole range of surgical art. My object has been to deal with the subject from a practical point of view, and I am

deeply conscious that I have imperfectly performed the task I have undertaken. Yet, in thanking you most sincerely for your considerate attention, I earnestly hope you will not deem me unworthy of the distinguished position in which, by your favor, I have been placed.—*London Lancet.*

THE PHYSIOLOGY OF THE SALIVARY SECRETION.

The precise mode in which secretion is affected is still, notwithstanding all the attention that has been bestowed upon it, shrouded in considerable mystery. In the case of the kidney, various evidence tends to show that the watery part is eliminated at one part and the salts at another, but scarcely any positive facts of this nature are known in regard to other secretions. An able article has, however, just been published by Heidenhain in the last part of Pflueger's *Archiv*, which seems to throw some light on the point in question. The proposition Professor Heidenhain endeavors to establish is that the secretion of water and salts on the one hand, and of organic material on the other, are not in direct casual connection with each other, but are separate acts under the control of two different sets of nerves, the secretory and the trophic, which, however, for the most part, run in the same nerve-trunks. The facts on which he relies to prove this are, that whilst the activity with which saliva in the case of the submaxillary gland is secreted augments with the degree of stimulation applied to the nerves provided these are not exhausted, the percentage of salts increases likewise to a certain maximum, quite independently of the previous condition of the gland. On the other hand, the percentage of organic matter it contains, though also augmented with the degree of stimulation applied to the nerves, does not bear a constant ratio to this, but is strongly influenced by the previous condition of the gland, and especially by the intensity and duration of the previous excitation. If the gland be continuously excited for some time, it will be found that

though the quantity of the saliva—i. e., the quantity of water—remains the same, as well as the amount of salts it contains, the proportion of organic matters gradually decreases, because apparently the amount of pabulum in the gland is used up. That variations in the elimination of the watery and saline parts of the saliva on the one side, and of the organic matters on the other, do not run a parallel course, is further shown by several experiments. In the first place, taking a fresh and unexhausted gland, if the strength of the stimulus be gradually increased, the flow of saliva augments, and with it the proportion of both organic and of saline constituents, but the former in larger proportion. But if to a gland already exhausted a still stronger stimulus be applied, although it appears to respond to the lash, it does so only so far as the watery and saline constituents are concerned, the organic material either actually diminishing, as occurs with a moderate increase in the strength of the current, or requiring a very strong current to produce a very slight increase, and even this, if the gland be much exhausted, may altogether fail. Lastly, if in a fresh gland the stimulus be gradually increased, and then again diminished, in intensity, the quantity of the saliva as well as of the saline and organic constituents will be found to rise and fall, but not in equal proportion, the water and saline parts diminishing to a greater extent than the organic, the difference being better marked the more intense the temporary increase of stimulation is, from whence Heidenhain concludes that a very strong stimulus leaves a secondary or after-condition which renders the gland more disposed to eliminate organic matter. It would thus appear that there is an intimate connection between the water and the salts of the saliva, the proportion of these rising and falling together in accordance with variations in the strength of the stimulus; whilst the amount of the organic constituents, though broadly agreeing with these in its variations, yet follows laws of its own; and it is this difference which leads him to think that the elimination of the watery and saline constituents is under control of one set of nerve-fibres, the secretory, whilst the organic substances are subject to the influence of another set, the trophic nerves.

Professor Heidenhain next proceeded to investigate the relations of the parotid gland, which, as he remarks, there is no

ground for assuming should necessarily present the same behavior as the submaxillary to the nervous system. He corroborates Loebs' statement that the motor nerve of the gland runs in the nervus petrosus superficialis minor, and points out that the parotidean saliva is not always so watery as is generally supposed, that it is liable to remarkable variations in regard to the amount of organic and inorganic constituents, and that, under different conditions, the quantity of the latter held in solution is double, and of the former twenty-five times, the ordinary amount. In regard to the influence of stimulation of its nerves, the effects are in all respects similar to those already described in the submaxillary gland. He found, moreover, that the sympathetic nerve possessed a powerful influence over it; since if this was stimulated shortly before, or coincidently with, Jacobson's nerve, there was an immediate increase in the quantity of organic substances eliminated by the gland, though there was no increase in the absolute quantity of fluid discharged. The sympathetic contains the vaso-constrictor fibres of the gland, and it might be supposed that the change in the secretion was due to changes in blood-supply, but a very curious fact came out from his further experiments—namely, that ligature of the carotids, though somewhat diminishing the absolute amount of saliva eliminated, had no influence on the solids it contains, either in the case of the parotid or of the submaxillary gland, which shows well the complete independence of secretion on blood-pressure.

Heidenhain next undertook to examine the parotidean saliva of the rabbit, in relation, on the one hand, to the chorda tympani, which was shown by Rahn to contain secretory branches for this gland, exciting the flow of what may be called cerebral saliva; and on the other to the cervical sympathetic, which v. Wittich and Nawrocki have shown to lead to the secretion of so-called sympathetic saliva. The parotid of the rabbit is well adapted for experiments of this nature, since it contains a diastatic ferment that is absent in the secretion of this gland in the carnivora. He found that small quantities of pilocarpin injected subcutaneously produced the same effect as stimulation of the chorda tympani—gave, in fact, an abundant flow of cerebral saliva, probably by acting on the same mechanism in the gland. The cerebral or pilocarpin saliva contained only 1.02 to 2.05 per cent. of solids,

whilst the sympathetic saliva contained no less than from 3.72 to 6.65 per cent., the greater part consisting of organic matter. The secretory fibres of this gland, therefore, run in the glosso-pharyngeal and chorda tympani nerves, whilst the trophic are contained in the sympathetic of the rabbit. The histological changes in glands that occur with variations in the activity of secretion seem to differ to a very remarkable extent. We have no space for the details of the experiments he gives.

Prof. Heidenhain advances the following view as the most satisfactory explanation of the facts he has observed. We must presuppose, he says, the presence of some substance in the cells having a strong affinity for water, and it is not unreasonable to assume that the protoplasm constitutes this substance. Water is first abstracted from the lymphatic spaces, and then secondarily from the interior of the blood capillaries; and imbibition takes place in the protoplasm till a state of equipose is attained, no change occurring as long as the gland is at rest, though the tension of the water in the protoplasm is considerable. The effect of excitation of the secretory nerves is to induce a change of the molecular arrangement in the limiting layer of the protoplasm on that side of the cell which is turned towards the lumen of the acinus, in consequence of which diminished resistance to the act of filtration occurs at this part. Water consequently escapes, the outflow being perhaps maintained or increased by contraction of the protoplasm, as Kühne has actually observed in the cells of the pancreas of the rabbit under the microscope. The tension of the water in the cells falls below the imbibition power of the protoplasm, and a current sets in from the blood capillaries, and the escape of water from the inner surface and the absorption through the outer surface of each cell continue as long as the protoplasm contracts under nerve influence. When the excitation ceases, the protoplasm returns to its former condition, the current stops, and the gland returns to a state of rest. This view, it will be observed, does not make the excretion of water in any way dependent on the blood pressure, whilst it explains why no more water leaves the capillaries than is required to make up what is withdrawn from the lymph spaces, why, however long the excitation is applied, the lymph spaces never become charged with excess of fluid, and why the excitation is

neither accompanied nor followed by any increase of lymph in the efferent lymphatics.

The functions of the trophic nerves, he thinks, is to lead to the formation of soluble organic substances in the gland cells, which are dissolved by the fluids eliminated under the influence of the secretory nerves. The organic constituents are not formed directly from the protoplasm, but during the period of rest substances are formed which stand in close relation to the specific constituents of the gland. Thus, in case of the pancreas, during rest, the zymogen of the trypsin is formed, from which the trypsin is afterwards developed; and thus in the mucous glands, not the easily soluble mucin itself, but a substance that is easily convertible into mucin, is formed. It would otherwise be unintelligible why mucin does not appear in moderate quantity on slight irritation of the chorda, when the aqueous portion of the secretion is slowly percolating the cells. We thus obtain an explanation of the reason why the cells of quiescent mucous and serous glands are relatively poor in protoplasm, presenting a clear and but slightly granular aspect, whilst they are rich in the mother substances of the products of the secretion. And hence, too, we learn why, after persistent activity, the glands are rich in protoplasm, as indicated by their marked cloudiness and granular aspect, whilst they contain but little of the material proper for the production of the organic constituents of the gland. In what mode the trophic nerves effect the conversion or aid in the elimination of the organic substances of the gland, Prof. Heidenhain does not attempt to explain.—*London Lancet.*

REAL BROWN BREAD.

BY A. H. CHURCH.

Notwithstanding the labors of chemist and physiologist, the exact composition and nutritive value of the several products obtained in milling wheat have not been thoroughly determined. That fine flour contains less nitrogen, and leaves, when burnt, less ash than biscuit flour, middlings, or any variety of bran, is well known. The percentages of starch, of the mixture of cellulose and lignose known as "fiber," and of fat, in several series of samples of mill products, have been ascertained. Moreover, there have been made many minute analyses of the ash of wheat and of the preparations derived from it. But we are still somewhat in the dark concerning both the chemical and physiological aspects of what may justly be regarded as the central feature of the problem under discussion. For we are not sure of the nature of the nitrogen compounds which exist in the several distinct parts of the grain of wheat; nor do we know how far the phosphates and such nitrogen compounds as may be ranked with the true albuminoids can be digested when intimately associated with fiber. Then, too, the mechanical condition of these coarser products from the milling of wheat is of considerable moment in estimating their actual value as nutrients.

* * * * * * * * * *

How much flour and how much bran will 100 parts of ordinary soft wheat yield on the ordinary system of low milling adopted in England? As the averages from an immense number of independent estimates, we may put down the flour at a total of 80, the bran at 17, and the loss at 3. Thus, from an economical point of view, we appear to lose $\frac{1}{5}$, or 20 per cent, of our wheat by submitting it to the numerous treatments involved in the manufacture of flour. But is this really the case? We think not, for much of the nitrogen in the rejected parts is not in the form of flesh-forming matter, and much that does so exist

in the bran passes unaltered and unused through the alimentary canal, because of its close incorporation with fiber. But, on the other side, we must not forget that the bone-forming materials are clearly deficient in wheaten flour, and that those phosphatic compounds present in bran are readily soluble to a large extent, not only in the several digestive secretions with which they come in contact with the body, but also in pure water.

But, in comparing and contrasting bread made from flour with that made from whole wheat, we must consider other points. We shall find it impossible to make, by means of leaven or yeast, a light spongy loaf from whole wheat finely ground, the so-called *cerealin* of the bran inducing chemical changes which result in a moist, clammy, dense product. Even whole wheat merely crushed into meal, and not ground, partakes of the same defect. Fine flour, on the other hand, yields a bread which is light enough before mastication, but which, when masticated, possesses a marked tendency to become compacted into dense lumps which never become penetrated by the gastric and intestinal juices, and which are a frequent cause of constipation. Whole-meal bread cannot be charged with this defect; indeed it acts medicinally as a laxative, and by reason of its mechanical texture is hurried rather too quickly along the digestive tract, so that the full virtue of such of its nutrients as are really soluble becomes in part lost. Yet there is no doubt that for many persons, especially those who have passed middle age and are engaged in sedentary occupations, whole wheaten meal in the form of bread, biscuits, scones, etc., forms an invaluable diet.

The following analyses represent, so far as a couple of sets of average results can do so, the percentage composition of ordinary white bread and of the whole-meal bread made by Messrs. Hill & Son:

	White.	Whole Meal.
Water	40.0	43.5
Albuminoids or flesh-formers*	7.0	10.5†
Starch, dextrin and sugar	50.7	40.6
Oil and fat	0.6	1.6
Cellulose and lignose	0.5	1.8
Ash or mineral matter‡	1.2	2.0

*Catculated from total nitrogen present.
†As much as 12.5 in some samples.
‡Includes common salt added.

It is clear from the above figures that if we could reckon the whole of the nitrogenous matter in whole-meal bread as equally effective with that contained in white bread, we should possess in the former a far more perfectly adjusted food, for the ratio of flesh-formers to heat-givers is about 1 to 7½ in white bread, while it approaches 1 to 4 in some samples, at least, of whole-meal bread. Add to this the higher proportion of phosphates in the latter, and its *chemical* superiority over white bread becomes still more marked; its flavor, too, is far richer.

One word as to ordinary brown bread will suffice. It is a poor preparation at the best. By adding a dash of rather rough bran to flour, we obtain a satisfactory or rich product: analysis demonstrates this fact clearly.—*Condensed from Nature.*

ANOTHER ACOUSTIC WONDER.

Remarkable inventions, like misfortunes, never come singly —or, at least, they do not in these latter days. One marvel doth tread upon another's heel, hardly allowing us to appreciate the wonderful character of its predecessor before eclipsing it with something more amazing. Before the novelty of the telephone had passed away the phonograph was announced, and the latter is almost immediately followed by the "microphone," as it is called. This instrument, devised by Professor Hughes, already well known as the inventor of a type-printing telegraphic apparatus, may be said to enlarge the sphere of telephonic hearing somewhat as the microscope does that of ordinary vision. It enables us not only to transmit ordinary conversation with perfect distinctness to the most distant points through the telephone, but also to render the faintest sounds audible in the same manner. When we are told that the brushing of a soft camel's-hair pencil over a wooden surface can be made to produce an intensely loud noise in the telephone a hundred miles away, and that even the footfall of a fly can be heard at a distance by the

same instrumentality, we are at first inclined to consider it as an ingenious scientific joke, intended to burlesque the achievements of the telephone and phonograph. The discovery is, however, no hoax; it is not only sober truth, but the apparatus by which the seeming miracle is wrought is as simple as the phonograph itself. Never were such astonishing results obtained by means so commonplace and cheap.

The basis of the new invention is the discovery that certain substances are peculiary sensitive to sound, as others are to light. If these substances are made part of an electric circuit, sonorous vibrations in their vicinity are taken up and transmitted through the circuit, and may be received and rendered audible in a telephone at any distant point. The new contrivance takes the place of the transmitting telephone, the receiving instrument being an ordinary telephone. The apparatus, as we have said, is simplicity itself. Two small blocks of gas carbon have little cups scooped in them, and are attached to a thin piece of pine. The latter is glued to a piece of thick wood, forming a base-board in such a way that an end view presents the shape of the letter L. A small stick of gas carbon (such as is used in the electric lamp), pointed at each end, is supported by the blocks of carbon, the points resting in the cups. Wires enter through the back of the sound-board into the carbon blocks which are thus connected, the one with a battery, the other with a line wire. A Bell's telephone, at the other end of the circuit, is connected with the line wire and the battery—and that is all. Even when the instrument is constructed in the roughest manner, it is so sensitive that the stroke of a feather on the base-board becomes audible to the listener at the telephone miles away. Speech is transmitted with wonderful power and distinctness, and soft sounds are converted into loud noises.

Instead of the pointed carbon we may use as the speaking instrument a glass tube filled with "white silver powder" (finely divided tin and zinc mixed together) and plugged at each end with pieces of carbon pressing against the powder and having the wires attached to them. This tube is laid upon a sounding-box or resonator: that is a box of thin wood with one of its ends open. The box is used as a mouth piece, and the whole forms one of the best articulating telephones ever devised.

The experiments of Prof. Hughes, of which we cannot take space to give a detailed account, show that a variety of other substances may be used as the transmitter. Perhaps the simplest combination he tried was composed of three French nails (nails made of wire) with the battery wire wound round two of them, the third simply laid across these two to complete the circuit. It seems almost beyond belief that these three nails can form a very perfect speaking telephone, and that words spoken near it, or other sounds, are taken up and transmitted to the distant receiving instrument with marvelous precision and power; but this is literally true.

This microphone is in its very infancy, as yet, and we cannot predict what may come of it when it is developed and perfected. As a means of conveying and reproducing sounds, it seems hardly possible that it can accomplish more than it has already done. To make a fly's footfall audible a hundred miles off would appear to be the utmost stretch of telephonic power. Fine-Ear, in the old fairy tale, who could "hear the grass grow," is almost rivaled by this acoustic achievement. But if the instrument, in its earliest and crudest form, can perform a feat like this, what may we not expect of it when further experiments have shown what is the most sensitive substance for receiving the sonorous vibrations, and the most effective way of using it? May we not be able to hear the sounds made by molecular motions, the ring of the atoms as they clash in their countless collisions? At least, we may hope that it will prove a most valuable aid in the investigation of these molecular motions, and will open up a wholly new field of research and experiment in which most important discoveries may be made.—*Boston Jour. Chemistry.*

THE DENTAL PULP.

BY WM. A. PEASE, DAYTON, OHIO.

The consequences of the exposure of the pulp of a tooth are serious to the patient, and often perplexing and unsatisfactory to the dentist. That they should have remained so to this date is evidence of the difficulties and complications that surround the subject and our ignorance of the best means of overcoming the obstacles. Thus far they have been disappointing; nothing has yet been found that seems effectual only in exceptional cases, unless the exposure is recent and slight. Several materials have been used which the experimenters believed had some general efficacy, their opinions probably being colored by hope and the novelty to them of the materials used; yet the experiments, carefully repeated by others, failed to produce valuable results. After their application the pulp has not always died immediately, or, having died by the suddenness or severity of the application, quietly or unobtrusively, the effects of it were smothered by some antiseptic properties of the materials used, until the pulp was dessicated, or the case finally passed beyond observation. Occasionally the pulp has survived the most heroic and exasperating treatment; and we have heard of it in our societies or read of it in our journals, and many dentists, overjoyed at the result, have rushed to treat every exposed pulp, without discrimination, in the same manner, and without stopping to inquire if it were rational or even probable that the known properties of the materials were suitable for the case. Especially has this been the case if the dentist has obtained some notoriety for facility and frequency of debate, and if his writings, clothed in words idiosyncratic of his temperament, have seemed oracular.

There are some things that are self-evident and non-discussable. One of these is that the exposed pulp should never be

irritated; that all our efforts to save its life should be soothing, quieting. Entering the tooth by a minute thread, it expands to considerable dimensions, and requires an active circulation to nourish it. It is analogous to erectile tissue, in this, that when subject to irritation, it becomes suddenly engorged, but, unlike it, has no means of instantly relaxing when the excitement is past, and the consequences are congestion, blood stasis and death. Let me enlarge a little, even at the expense of seeming to explain what is axiomatic. In the normal condition of the tooth, the channel for the entrance and exit of the blood through the foramen is just equal to the healthy demands; there is no useless tissue between the afferent and efferent vessels, nor the nerve and the walls, nothing to yield to accommodate an increased volume of inflowing blood, which must impinge upon and diminish the capacity of the outflowing vessel. Consequently, any irritation of the pulp at the point of exposure must be responded to by an increased volume of inflowing blood that can not rapidly escape; hence the excruciatingly spasmodic action of the nerve to relieve itself of the pressure of the expanded blood vessels, and the frequency of its death under very slight irritation. We all know its extreme sensibility to heat and cold, sweets and sours, or anything acrid. Encased in bony walls possessing but little conductivity, what must be its astonishment and protest at the sudden invasion of its premises by the rapidly-cutting drill of the engine! It is the healthy, exposed pulp, that is now under consideration. The pulp is exposed, a condition pregnant to the thoughtful dentist with serious considerations, perhaps of self-upbraidings. What shall be done with it? Kill it and leave the patient to all the possible and probable consequences of it? This is the shortest way, or shall we attempt to save it, almost a forlorn hope? If we attempt to save it, what are our means? Those taught by the books and those used by the most considerate operators—are they rational, such as we would apply to the eye or an infant's mouth and expect no irritation? Irritation of the pulp is death; it may not be immediate, but it is generally sure. Let us look at creosote and carbolic acid. They are analogous, and are probably used more than any other means. What should we expect from the use of either of them on a tissue such as has been

described? They are escharotic on live tissue and antiseptic on dead. A singular remedy for so tender an organ as the pulp. Are they what we want? Shall we eat a hole into the pulp, hoping it will eventually cast off the eschar and get back to the point of beginning after the tooth has been filled? Where will it cast it to, or what will become of it? Will it lie an irritating substance between the filling and the pulp, pressing upon it? Will the pulp endure that, or will it be absorbed? If absorbed, the pulp has greater absorbing powers than any other part of the system, and there is no reason, situated as it is, why it should have any, unless nature anticipated that there would be dentists, and that they would apply creosote. The same matter, in the same form and condition, antisepticised, inserted under the mucous membrane or the skin, would not be absorbed; but it would come to the surface by ulceration. Besides, we can not see why creosote or carbolic acid should have first been used by a dentist, unless it was done empyrically and in desperation. They are used indiscriminately and unconsciously for two purposes. As escharotics, they relieve pulpitis by lessening tension; and as antiseptics, they relieve incipient periositis by stopping the formation of gas. But to use either of them as an ingredient of a cap, leaving it there to simmer, vaporize and eat into the pulp, is simply to drive it into fits without any possibility of a cure. If this reasoning be correct, then any irritating material is objectionable in proportion to its irritating properties. This will include all of the tinctures, even though they carry sedatives, as the action of alcohol is instantaneous and irritating to a healthy surface. Having examined the usual remedies and found them objectionable in feature and rarely efficacious, we find we have limited our means very much, without having offered anything as a substitute that experience has sanctioned. Perhaps the most satisfactory material of recent trial is white lead, white lead and chalk, or creta prep. alone; each of them carrying a sedative in watery solution, and to be applied directly to the point of exposure, and capped by a bit of sheet lead. If time will admit, a sedative, as a little morphine applied to the place an hour before, is desirable; then cap as above; cover with os artificial, and there should be little or no pain if the materials are not too flowing and the cap is large enough to

shield the sensitive parts. Here there is no pressure and nothing acrid; the little chalk that escapes from under the lead cap helps to neutralize the acid of the os when the dentine is thin; when it is thick, there is no need for it, but where practical the lead cap should cover all of the dentine nearest to the pulp. All of these materials are soothing except the os, and it should be kept out of the way of harm; and when the nerve awakes from its slight narcotism it should be bright and buoyant, ready for everything it has to do. Sometimes I have omitted the os and plugged over the lead cap with amalgam, and at others have cut a thin piece of spunk to the proper shape, struck it with a hammer to condense it, laid it over the lead and plugged with gold or amalgam. Soon after I commenced using spunk, I was filling the second lower molar with gold, when it commenced aching severely. The filling was removed, but no exposure could be found. It was evident from trials that the filling could not be borne, and the temperament and age were not promising for destroying the pulp. Here was a dilemma. I cut a piece of spunk as described above, covered the bottom of the cavity with it, touched it with a particle of creosote to correct effusion, if any, and the filling was a success. It gave a very comfortable feeling to the patient, and in favorable cases of slight exposure is a success, as it prevents distressing spasms produced by sudden thermal changes. I have been in the habit of using this for more than fifteen years, with more satisfaction than any other material; but the exposure must be slight, and it must be used with discretion.

The death of the pulp after filling the tooth, when no exposure exists, or where it is very slight, is too frequent; but where exposure exists it must be expected in many cases, unless the greatest discrimination is used in regard to the teeth and the patient. Pulps die quietly, and without aching, in teeth where they have been and have not been exposed; and their taking off is probably greater just before exposure, in abraded teeth, and where decay has been slow. It must be expected, therefore, that the sudden changes incident to the preparation of the cavity and the insertion of a metallic filling must materially increase the mortality. These deaths have given endless trouble to dentists, which has served to fix the fact in the mind to such a degree,

that many of them believe there is a tendency in the pulp to die; that at some indefinite period they cease to be useful to the tooth; that they then gradually withdraw, filling their chambers with dentine as they retire.

They assume the effect to be the cause; the necessity, the reparatory effort, to be volition, in obedience to a natural and predetermined law; the effort of Nature for self-preservation, to be a voluntary abdication of function, a negation of the harmony and equilibrium of the system. A disturbing element is introduced to plague and embarass the assimilating and emunctory organs, at a time of life when they most need all the auxiliaries that the system can provide. They can not see in it a physiological action, a barricade against a physiological danger, a supreme effort at self-preservation, and a wonderful choice of means, never used unless as a precaution to guard against aggression. The pulp is not made for self alone, but to guard the house it inhabits from other dangers and other foes. Its loss begets periosteal complications, that may result in necrosis, by which I mean not exfoliation, or acrid or gradual solution, but denudation and an inability to receive nourishment for a longer or shorter space, beginning at the apex of the root. Complete denudation is absolute death, when the tooth must be cast off as a foreign body; and partial denudation necessitates the intervention of a cyst to protect the soft parts from puncture or laceration from the point of the bare root. Wherever aberration or loss of function takes place in any organ it does not stop there, but the sequences of it are almost unending. The death of the pulp is always accidental or circumstantial, and is not due to hereditary or an acquired or natural tendency. The teeth that are called permanent, were not designed to be shed at any period during life, or to have their usefulness injured by periosteal complications. Whenever these occur they are adventitious, not contemplated by nature, and are due to the accidents and diseases of life. Most of the gum and alveolar diseases are due to carelessness or negligence, the administration of improper medicines, or to a hereditary cachexia, that was acquired by more or less remote ancestors. There is nothing in the teeth, structural or otherwise, or in the surrounding parts, that implies that the tooth tends to obliteration; that

it grows feebler and feebler, in any greater ratio than the other parts of the system; or that at any time its service can be dispensed with, without material detriment. What is the natural type of the teeth? Such as we see now, or such as we occasionally glimpses of, large, solid, strong, beautiful as minted gold, and almost as enduring; so perfect that the fruits, grains, meats, unaided by cookery, should be preferred by them for sustenance and a vigorous life. Could the first man have lived to the age that he did, plagued with the toothache, and bolting his food without mastication, if the pulp tended to obliteration then, as it is said to now? Would the average teeth of the people of our cities serve for that purpose? Have they improved in structure and health under our modern mode of life and cookery, which deteriorates them by disuse?

Whilst nature did make provision for the accidental loss of the teeth, by providing for the absorption of the socket, which must otherwise have remained open and foul, there is no evidence that she contemplated it on a large scale, or otherwise than as an accident. She protected the pulp as she protected the important nerves and arteries, in an inaccessible place, secure from danger. The known longevity of the pulp, which is not exceptional, the tenacity with which it clings to life, when its home is scarcely habitable, and the disastrous consequences following its loss, for which human ingenuity has not yet found a remedy, all lead to the inevitable conclusion that nature intended it to stay in the tooth through life. The conclusion is fortified by the complex plan of the teeth, as to purpose and function, arranged as they are with reference to the wants of a being of the highest organization, and the most diverse needs, and for the preparation of food, embracing the greatest variety of materials for incision, tearing, grinding, an apparatus more complete than any other animal has, and comprising also all of the peculiarities and excellences of each. Its completeness shows its need, not for youth, not for middle age, but for all life: for the complex, sensitive and easily disturbed organs standing back of it, depended on its complete discharge of function for the discharge of theirs. Caries may invade its habitation and it succumbs, but not without a terrible protest; abrasion may slowly invade it and it cautiously erects barricades against it, and

does all within its limited means for protection; but this comes in few instances and late in life, and is either without the normal plan of nature or an accident. Incision to be perfect demands that the incisors should pass each other and not meet in direct antagonism, to be constantly dulled and worn out of edge. The usual arrangement of the human incisors and canines, is for the edges to lap by each other, and if there is any wear it is to sharpen and not to blunt. The exceptions are few and rarely congenital. They generally arise from a loss of the molars and bicuspids, which gives a longer sweep to the lower jaw, and brings the incisors into constant use and antagonism, and ultimate abrasion follows. This happens late in life, while the devitalization from caries and other causes is generally early.

Forty years ago my medical reading and oral teaching was that the teeth of very old persons had no pulps in them; that at some indefinite time in their lives the pulps disappeared, become obliterated, the tooth filled up solid, and as I thought then, painless; for at that time, if I recollect rightly, we were not instructed about periostitis. Having an aching tooth then, I recollect that I thought that if age had some inconveniences it also had some compensations. But this theory was of short duration; for among the first teeth I extracted were two for husband and wife, both over ninety years old, and both teeth had healthy pulps in them. They were opened with eagerness to see how a pulpless tooth, with the cavity obliterated would look; and great was my disappointment to find not only a healthy pulp but a normal chamber for it to live in. Since then I have broken several pairs of forceps in splitting teeth for a special study of their pulps.

More than forty years ago I had a bicuspid filled in both its front and posterior faces; one of the fillings was subsequently removed and about twenty years ago the crown broke away leaving a sharp edge on both the labial and lingual faces. I went to a dentist who has recently added to his reputation by his writings on diseases of the gums, to have it filed smooth. He advised extraction, said it was too short to be of any use, it would probably be troublesome, etc., but he consented, saying, "You know what you are about." To-day I have examined that

tooth, and bit a piece out of my finger nail with it. It is slightly crescent shaped, the surface bright and polished except a slight stain on one edge such as is frequently seen on molars that have lost their enamel; and it is now on edge from having eaten sour apples. It has never ached, and it has as lively a pulp as need be, though the house it lives in is dilapidated and circumscribed. I am now building up the crowns of the six front teeth, for a gentleman about seventy years of age, that were so abraded before he consulted me, that the pulps were dying, They were removed having just begun to generate gas, but they were yet plump and whole.

These examples might be multiplied indefinitely; they are of frequent occurrence and they are not exceptional. I have been thus particular to show that the pulps may die like human beings from little or great provocation at any time from youth to old age; but they have no predisposition that way; if they do not hanker after longevity they are at least content to live as long as the house that contains them is protecting and habitable. The theory that seems to be getting introduced now is I think pernicious, viz: that the pulp tends to obliteration—to die on the slightest provocation. The consequence of this is a lack of study, a slovenly and harsh way of treating it, because its tendencies being to death, whatever may be done, will be ineffectual.

It is this doctrine of fatality that I wish to correct in order to give life to investigation. It seems to be evolved more from the inner consciousness, than from accurate and prolonged observation. Like the vaticinations of the Roman sooth sayers, from an inspection of the entrails of birds, this inspection of the folds and duplications of the primordial membranes may give an equivocal omen, that may be interpreted in two ways, or, at least, give rise to mortifying exceptions. I hope it has been misinterpreted. I can not believe that nature intended that the pulp should die, while the tooth is habitable, or, that the permanent teeth have a tendency to be shed during the life of man. And I hope that some of the means now used may be found effectual in saving the life of the pulp, or that other methods may be found by further study.

In this paper I have noticed some of the means used for sav-

ing the life of the pulp, and some of these I deem objectionable. In another I shall notice some of the means used for treating a tooth after the pulp is dead; after which, the way having been prepared, I hope to notice the measures and methods of filling the teeth and what may be expected from them.—*Dental Register.*

AN INDEX RERUM OF DENTAL LITERATURE.

BY D. C. HAWXHURST, D. D. S.

The man who does not read dental literature will probably care very little about an index of the same. The suggestion which I am about to make is designed for the benefit of those practitioners of dentistry who read more or less of the book and magazine literature of our profession, and who might wish, on any given occasion, to consult off hand and at a moment's notice, whatever writings are in existence relative to any particular topic. The literature of most topics is scattered through different books or chapters, and widely disseminated through the various magazines of the day.

The plan is one which involves the making of an entry in a book prepared for the purpose, every time an article has been read containing important suggestions on any topic whatever.

As the name, index rerum, indicates, it is simply an index of readings. The busy practitioner must have observed, that at the very time when he wishes to make use of some important fact or principle that he remembers reading somewhere, he often forgets where he read it. By means of an accurately kept index of his readings he would be able to turn at a moment's notice to everything which he had read on the subject, or to any special article.

Suppose, for instance, that a patient presents with a tooth whose crown can not be saved by filling. It is desirable to

mount a crown on the root. For some reasons the ordinary method of pivoting is contra-indicated, and can not be employed. The practitioner wishes now to refresh his memory on rare and unusual methods of pivoting. Descriptions of these are to be found throughout the various volumes of the Dental Register, Dental Cosmos, Dental Miscellany, Dental News-letter, and in every other dental journal, ancient or modern, in this country or in Europe, and probably in a number of books also. If the practitioner is a very old one he will have read the most of these, will have indexed them under the head of "Pivoting Teeth," and will in the main have forgetten them. But, on reading their titles, he will recall enough of each, especially the more modern ones, to enable him to determine which to re read. Often he will go to his index rerum, remembering exactly what he wants, and only seeking the name and the number of the journal which contains it. Or he may desire to make an exhaustive study of the whole subject, and will then go to his index as a guide to its literature. By means of such an index, every important subject from neuralgia to vititiated oral secretions, from alveolar abscess to dentigerous cysts, may be at once referred to and everything that has been read on the subject brought under view.

In this case each practitioner makes his own index rerum; he knows what his own purposes are, and will not index an article unless it contains something that he believes will be of use to him in the future. He may leave out two-thirds of the articles written on any topic, either because they are in themselves worthless, or because whatever is good in them is embodied in other and abler articles already indexed.

This will prove a great saving of labor, when in future years he desires to investigate any subject thoroughly and with the least possible expenditure of time and effort. He may still further economize time by indicating in his index the important paragraphs to be consulted.

Such an index can not but be a valuable aid, not only to the writer and investigator, but to the practitioner in his office and laboratory. Indeed, no professional man can afford to be without it, for it gives him a wide and ready command of all that he has read. It does not propose to preserve for him important

notes and hints drawn from his reading, which indeed would be a highly useful result; it does more; it enables him to refer at once to the original article and point out the important paragraphs. It does this by noting for his use precisely what no living man can himself remember, the name, year of issue, number and page of the periodical or book containing what he sees.

In my opinion every dentist who is about to begin the practice of his profession, and has procured the ordinary stock of instruments for that purpose, should make three additions to this outfit—a wife, a microscope and an index rerum.

Passing over the first two, I should say that he will find the index rerum of John Todd highly suitable for his purpose. It is a well bound volume of several hundred blank leaves, lettered for the convenient entry of subjects, and containing a preface which fully explains how to use it. It may be ordered from any bookseller, at a cost of two or three dollars. An ordinary blank book may be made to answer a similar purpose. Even a small blank book that shall cost but the trifling sum of twenty-five cents can be made to serve an excellent purpose if the reader is really a poor man. Or a quire of paper may be purchased for a dime, and stitched at the back, which will give forty-eight pages. At the top of each page may be written some important subject. Here is an index rerum which will last till the young practitioner has grown older and richer.—*Dental Register.*

To Make Corks Air-Tight and Water-Tight.—A German chemical journal commends the use of paraffine as the best method of making porous corks gas and water-tight. Allow the corks to remain for about five minutes beneath the surface of melted paraffine in a suitable vessel, the corks being held down either by a perforated lid, wire screen, or similar device. Corks thus prepared can be easily cut and bored, have a perfectly smooth exterior, may be introduced and removed from the neck of a flask with ease, and make an absolutely perfect seal.

MICHIGAN STATE DENTAL ASSOCIATION.

PROCEEDINGS OF A SPECIAL MEETING HELD AT ANN ARBOR, FRIDAY, DECEMBER 13TH.

The State Dental Association, Dr. George L. Field. of Detroit, presiding, met at Ann Arbor, on Friday. The object of the meeting was especially to consider the needs of the Dental Department of the University, and also the matters which the Association desired to lay before the coming legislature.

Dr. G. R. Thomas, of Detroit submitted a circular letter, to be sent to members of the profession, and a memorial to the legislature, embodying his views on the subject for which the meeting was called. The following is the circular letter, explaining both matters:

"Believing that you are in sympathy with the success of the Dental Department of the University of Michigan, the undersigned desires to call your attention to a few facts in relation to its establishment, its present and prospective needs. It is now nearly four years since its establishment, by an act of the legislature, since which time it has increased at an average rate of more than 40 per cent each year; this, we think, may fairly be regarded as evidence of permanent growth and of high appreciation by the profession throughout the country.

"This is especially encouraging, in view of the fact that the term of study each year is larger than that of any other school in the country, with perhaps one exception, while the standard of attainments for entrance into both junior and senior classes is far higher than that of any other dental college in the land. When the department was established, the appropriation was for only two years, at the end of which time a second appropriation, somewhat larger than the first, was made to carry it along for two years more. It is confidently believed now, with a class of sixty-two students, that the permanency of the department is fully established, providing proper legislation can be obtained for a sufficient annual appropriation, which should be, in our judgment, not less than $7,000 per year. Judging the future by the past, there will be, next session, from eighty to one hundred

students, and an increase of students makes necessary an increase of apparatus, appliances, and all the facilities for teaching. To meet the wants of the present class it was found necessary to provide more room. To do this the honorable Board of Regents acted very promptly, ordering the construction of a new building, to be used as an infirmary and laboratory, thus making ample provision in this direction for the present number in attendance.

"An addition to the present corps of teachers should be made at once, especially in prosthetic (mechanical) dentistry. There should be more teachers in this department for the thorough and successful prosecution of the work, but with an appropriation as heretofore an increase of teachers is out of the question. You are earnestly requested to take a little time and lay the matter before the member from your district, and urge upon him the necessity of the passage of such a measure.

"You will also find inclosed a blank memorial, urging upon the members of the coming Legislature the necessity of the enactment of a law having for its object the means to enable the proper officials of the State to secure to this Commonwealth a guarantee of the completing of a course of study by those who shall commence the practice of dentistry hereafter within her borders. You are doubtless aware of the fact that our State is already being flooded with incompetent men, who are debarred from practice in the States where similar laws already exist. We ask you to make this a personal matter and secure all the names possible among your townsmen, and mail it to Dr. G. R. Thomas, No. 86 Lafayette avenue, Detroit, Mich. Do not wait for men to come into your office to sign it, but take a day outside of your office for this special purpose, and do it at once, that it may be ready for use by the first of January next."

The business of drawing up a proper bill for regulating the practice of dentistry, to be presented to the Legislature, was left in the hands of a committee appointed at the last meeting, consisting of Drs. Thomas, of Detroit, Perry, of Grand Rapids, and Jackson, of Ann Arbor.

The memorial and circular letter was discussed by the different dentists present.

Dr. Field believed that the present controversies between the pathies, and the trouble experienced at the last commencement, in March, when the awarding of diplomas was delayed by the proceedings of the Regents, had injured the University very largely. He thought that the professors would have to work harder for the appropriations than they otherwise would have had to.

President Angell, who was present, was called upon for his views in respect to the Dental College, and as to what appropriations were needful and necessary. He thought that a permanent appropriation was preferable to a biennial one. The Dental Department was the only department in the University now, which was not upon a permanent foundation. The percentage of the growth in the number of the pupils had never been equaled in the history of any of the other departments of the University. The success which attended the Dental College would strongly recommend it to the members of the Legislature. The executive committee of the Regents would meet in Ann Arbor next week to consider the matter of the general appropriations necessary for the University, and they would be glad to receive from the association any expression of its wishes in regard to the Dental Department.

Dr. Field called attention to the statement which had been published in the *Post and Tribune* to the effect that a dental student had been expelled for drunkeness. This was untrue as no such expulsion had taken place.

The Treasurer was instructed to solicit money from the members of the profession to meet the expenses which were incurred in taking the measures necessary for the proper presentation to the legislature of the bill for regulating the practice of dentistry.

On motion of Dr. Douglas, a resolution of thanks to President Angell and the Board of Regents for the appreciation of the Dental School which they had exhibited, in causing the erection of the additional new building, was unanimously passed.

The dental students were then called in, and Dr. Field addressed them, after which the Association adjourned.

A MAN WHO BURST.—In the *Vierteljahrsschift für Gerichtliche Medicin*, Dr. Bremsue gives an account of a man who literally burst from taking four plates of potato soup, and many (how many is not stated) cups of tea and milk, followed by a large dose of bicarbonate of soda to aid digestion! His stomach swelled enormously, and tore the diaphragm on the right side, causing immediate death.

ASCLEPIAS SYRIACA ON SUPPURATING SURFACES.

The September number of this JOURNAL contained an article by Dr. G. F. Waters, of Boston, on the "Alkaline Treatment of Burns and Scalds," in which mention is made of an unwritten essay, on the above named subject, delivered by Dr. W. before the Massachusetts State Dental Society. For the purpose of demonstrating the virtues of the new method of treatment Dr. W. scalded, for thirty seconds, a zone seven centimetres broad around his wrist, and then arrested the pain by the application of bi-carbonate of soda to the scalded surface. Afterwards an accident happened which delayed the healing of the wound, and this occurrence gave rise to a report that the experiment was unsuccessful.

In a subsequent communication to the *Boston Daily Advertiser*, Dr. W. thus explains the accident, and the circumstances that led to the use of *Asclepias Syriaca :*

"I proceeded to give the cause of the pain in such cases, and the philosophy of the cure, and was arrested in the midst of my philosophy by a sharp twinge of pain in the surface most severely scalded. An investigation showed my pearl sleeve-stud to have become, at one point, subcutaneously involved. I had neglected to provide for keeping the surface wet, and as the cooked epidermis dried, the pores closed and the vesication began. At the most favorable point for a prolonged operation the stud took the skin at the base of a blister. I was too much pre-occupied with my subject at the time to observe just what had occurred, and, without stopping in my essay, I withdrew the stud and turned the wristband upon the arm, so that it should not have another dig at that place. In a very few moments my attention was called to something wrong in the same place. An investigation showed that the edge of the cuff had entered the opening made by the stud and caused a rupture of continuity in two diverging lines, five and seven centimetres long respectively. The cuff was at once withdrawn and by a piece of bibulous paper, which was kept subsequently wet for two or three days, prevented from again entering the skin at that point. But for this accident the burn would have been practically healed in less than a week. As it was, however, this rupture remained an open suppurating wound long

after the rest of the arm was well. When the desquamation of the epidermis took place over the bruised parts, I left off applying water, and covered the pus with pieces of epidermis taken from the adjacent parts, and as they soon dissolved in the pus and exudate, I added dry bibulous paper as a cover and to serve as a nucleus of a scab. I had read about the application of dermal scales to such surfaces, and that they seemed to dissolve in the pus, and that soon islands of skin appeared at these points. I thought such a liberal supply of scales as I had made should give an island from shore to shore or a continuous surface, and I constantly lifted the scab day after day to see what the first steps of the formation might be. There was no perceptible change in the broad expanse—two centimetres at its broadest part, where the rupture began, and one centimetre at the ends—but the margins were better defined and looked as though graulations were taking place. My mind ran on that subject; was getting decidedly rutty in its speculations on dermal scales, white blood corpuscles, liquor sanguinis, albumen, etc.

Standing one day whilst in this mental condition near some milk weed, (*asclepias syriaca*), the leaves of which I had broken from some of the flowering stems, and observing the white juice, it occurred to me that the application of dermal scales was but the application of dessicated animal albumen, and that as the scales dissolved in the pus and lymph, perhaps if the surface was made dry and then supplied with vegatable albumen it might do as well or better. As I had a vague sort of recollection that some one had said to me at some time in the dim past that it was poisonous, I felt that it might not do at all. So I proceeded cautiously to experiment with it upon my arm. I removed the scab from a portion of the wound at one end and applied the white juice to rather more than two centimetres of the raw surface which I had freed from pus with bibulous paper. It caused some smarting when first applied, which was of short duration, and when it ceased I covered it with a small piece of bibulous paper, and thought no more of it for twenty-four hours; The next day, near the same hour, I was calling on a medical friend, who asked after the condition of my arm. I at once removed the paper, which came readily away, and found, to my surprise, that the entire surface, to which had been applied the asclepias, was now covered with a very thin, though perfect, silky derm; no pus had formed after the asclepias was applied. I now decided to space off the rest of the surface, and apply asclepias to each space in succession as they healed."

The worst scald was on the palmar surface of the wrist. This space was the last treated with the milky juice, and was thirty-six hours in healing. The other spaces "showed a

continuous dermal surface" in from twenty to thirty hours. The surfaces of the spaces were successively dried with bibulous paper and the remedy was applied but once to each space.

THE COMPOSITION OF PUS.

The twenty-fifth part of Fehling's *New Handwörterbuch der Chemie* contains a short but carefully worked-up article on Pus, in which, after some preliminary account of its general characters, the following particulars are given. The constant chemical constituents of pus are water, alkali, albuminate, and three other albuminous bodies, one of which coagulates at 48° to 49° C., and is soluble in a 0.1 per cent. solution of common salt and in a dilute solution of soda; a second insoluble in water, but swelling up in a solution of salt, and soluble in a 0.1 per cent. solution of hydrochloric acid; and a third insoluble in solution of salt, but soluble in a 0.1 per cent. solution of hydrochloric acid; in addition it contains nuclein, fats, soaps, cholesterin, lecithin, cerebrin, phosphuretted fats, and inorganic salts, of which the chief are sodium chloride, phosphates and carbonates of the alkalies, phosphate of lime, and some iron oxide. The nuclein albuminous constituents, cerebrin, cholsesterin and lecithin, belong to the pus-corpuscles. The occasional or, as they may be regarded, abnormal constituents of pus are mucin (from mucous membrane), chondrin, gluten, chlorrhodinic acid, pyocyanin and pyoxanthosis (in blue pus), biliary acids and pigments (in the pus produced in icteric patients), grape sugar (in diabetics), and urea. When long exposed to the air, pus passes into acid fermentation, and then contains leucin, formic, butyric, and valerianic acids. Hoppe Seyler found in 100 parts of the serum of pus: water 90.96 per cent; solids, 9.04, of which albuminoids formed 7.02; lecithin, 0.10; fats, 0.04; cholesterin, 0.07; alcohol extract, 0.06; water extract, 0.92; inorganic salts, 0.77. One hundred parts of dry pus-cells contained albuminoids, 13.726; nuclein, 34.057; insoluble substances, 20.566; fats, 14.383; cholesterin, 7.400; cerebrin, 5.199; extractive, 4.433; and nearly 2 per cent. of salts.—*London Lancet.*

Miscellaneous.

THE PROPER METHOD OF PREPARING POULTICES.—Dr. T. Lauder Brunton, in *Brain*, says: The common practice in making poultices of mixing the linseed meal with hot water and applying directly to the skin is quite wrong, because, if we do not wish to burn the patient, we must wait until a great portion of heat has been lost. The proper method is to take a flannel bag (the size of the poultice required), to fill this with the linseed poultice as hot it can possibly be made, and put between this and the skin a second piece of flannel, so that there shall be at least two thickness of flannel between the skin and the poultice itself. Above the poultice should be placed more flannel, or a piece of cotton-wool to prevent it from getting cold. By this method we are able to apply the linseed meal boiling hot without burning the patient, and the heat gradually diffusing through the flannel affords a grateful sense of relief which cannot be obtained by other means. There are few ways in which such marked relief is given to abdominal pain as by the application of a poultice in this manner.

TREATMENT OF FURUNCLES BY ARNICA.—Dr. Planat, of Nice, claims that arnica has the power of aborting an eruption of boils, except when due to diabetes, with extraordinary rapidity. His method of employing it is very simple. In order to render its action on the small vessels more energetic, he applies it directly to the inflamed spot in the form of an ointment, of which the formula is as follows:

Extract of fresh arnica flowers.....	2½ drachms.
Honey.....	5 drachms.

If the mixture be too fluid, he adds powdered lycopodium or althæa, or some other inert powder, until it acquires the proper consistency. It is then spread pretty thickly on a bit of oiled silk or diachylon plaster and applied directly to the boil. It is rarely necessary to renew the dressing more than once in twen-

ty-four hours. As a rule, two or three dressing are enough to make the furuncle abort, no matter what may be the period of its evolution.

A curative action is also obtained by the internal administration of the drug. Dr. Planat gives from three to four drops of the tincture, largely diluted, every two hours, and he has seen the furuncular eruption disappear very rapidly under the treatment.—*Jour. de Med., etc., de Bruxelles.*

THE PHYSIOLOGICAL ROLE OF THE HYPOPHOSPHITES.—At the *Academie des Sciences*, M. Ch. Robin presented a note from MM. Paquelin and Joly in the following words: "The pyrophosphates and the hypophosphites have been for a long time employed in therapeutics as reconstituents. We have shown that the pyrophosphates leave the economy as they entered it, without having undergone any transformation; that the whole amount is found again in the urine in the shape of pyrophosphates; that the ingestion of these products only increases the expenditure of the economy on account of the labor of elimination which their presence necessitates; that the pyrophosphates, in fine, very far from being reconstituents, as has been for nearly thirty years supposed, are found to be merely diuretics. Our researches upon the physiological action of the hypophosphites have led us to entirely analogous conclusions.—*Canada Jour. Med. Science.*

THE FOUNDER OF MODERN HISTOLOGY.—In the course of a few weeks a festival will be held in the city of Liége, to celebrate the fortieth year of the professorship of Theodore Schwann, the author of the cell theory. The founder of modern histology is actually, at this moment, alive, and teaching as Professor of Physiology in the Belgian University. The committee charged with the management of the celebration desire the coöperation of scientific bodies and of individuals in this country. It is requested that letters intended to be read at the celebration may be forwarded either direct to the Secretary, Prof. Edouard van Beneden, Liége, or to Mr. Ray Lankester, Exeter College, Oxford.—*Nature.*

CHLOROFORM AS AN ANÆSTHETIC.—M. F. Comes gives practical suggestions regarding the employment of chloroform as an

anæsthetic, and calls especial attention to its effects on different nationalities. The Irish, he says, will take more chloroform and are longer in yielding to its effects than any of the others specified. Americans yield to its influence with more ease and require less than Irish. Germans yield to chloroform with but little trouble, and are frequently anæsthetized without a struggle. Negroes are more easily influenced than either of the foregoing.—*Am. Med. Bi-weekly.*

OPEN AIR TREATMENT.—The "open air" treatment of wounds is meeting with its advocates. It is said to be extensively in vogue in Russia where dressings are dispensed with and the air allowed immediate contact. It is claimed by the advocates of this plan that Lister's treatment is useful only in that it renders innoxious the pernicious material of dressing, and that the plan of freedom from dressings and open contact with the air is followed by better results than any other.—*Mich. Med. News.*

SKIN-GRAFTING.—The use of warts for the purpose of skin-grafting is thus described by Dr. Charles A. Searle, of New York, in the *Medical Record:* "As common warts of the skin are collections of vascular papillæ, admitting of easy separation without injury to their excessively thick layer of well-nourished epidermis, the idea was conceived that, by their use for the purpose of skin-grafting, better and more rapid results would be obtained than when the ordinary skin of less vitality is used. As proof, the following case is cited, where there had been complete destruction of all the skin of the dorsum of the foot, involving to a great extent the deep cellular tissue, and where for several weeks no healing advanced until grafts of freshly removed warts from the patient's hand immediately started little islands of tissue, which rapidly increased, until they coalesced and met the margins of the border skin, thereby completely covering the foot by firm, protecting integument. Warts of the hand can be used with better results than small pieces of normal skin, in skin-grafting, in consequence of being easily separated, uninjured, into numerous cylindrical rods of great vascularity, and containing a large proportion of hypertrophied epithelium, which, when planted in healthy granulating tissue, readily adapt themselves to the new soil, receiving direct nourishment, and quickly grow as starting-points for a new and smooth epithelial covering."

Editorial.

WITH the issue of this number, we round off the labors of the year, and complete the tenth volume of the JOURNAL. The five numbers that have appeared since we took charge of its editorial columns may be fairly regarded as a type of what the general character of the JOURNAL will be under its present management. We hope to make it much better than it has been, and feel confident that a considerable improvement can be effected without changing its general scope. As a dental journal, its pages will be filled with the best matter obtainable relating directly to dentistry, together with subjects included in a rather wide range of collateral science.

We shall labor diligently for the procurement of good and useful material with which to fill our pages, but the quality, and the abundance of the supply, must depend largely upon such assistance as our professional friends may render us in this important work.

A NOTE.

PHILADELPHIA, Dec., 1878.

EDITOR MISSOURI DENTAL JOURNAL:

Will you kindly allow me a few lines to correct your evident misapprehension of the language which you courteously criticised as an "oversight" in your November issue. The statement which you commented upon was that "each issue of the *Dental Cosmos* contains at least fifty-six pages of reading matter—more than any other dental journal published," and you state the fact that the MISSOURI DENTAL JOURNAL contains sixty-two pages, as a correction. Your misapprehension was in having understood the "more" as referring to the number of *pages* instead of to the amount of *reading matter*, which was what was meant.

SAMUEL S. WHITE.

Book and Pamphlets.

TREATIES ON DENTAL CARIES. By Dr. E. MAGITOT. Translated by THOMAS H. CHANDLER, D. M. D., Professor of Mechanical Dentistry, and Dean of the Dental School of Harvard University. In one volume, octavo, $2.50. Messrs. Houghton, Osgood & Co., of Boston, publishers.

This work, by one of the foremost specialists in his department, is of the first value to all dentists. The scientific character of its discussion of the nature and causes of dental caries, and the practical character of the investigations and modes of treatment it records, give it a peculiar value and importance.

The work has been admirably translated by Dr. Chandler, who has added notes and suggestions that render the work more complete and useful.

Dr. Chandler says: "As far as is known to the translator, no writer has investigated this subject so systematically and thoroughly as Dr. Magitot, and his conclusions are therefore grounded on something more substantial than the speculations which have heretofore formed the basis of our 'knowledge' of this malady."

We propose to again refer to this valuable work and to note some of the views advanced by the author.

GRAY'S ANATOMY. By HENRY GRAY, F. R. S., F. C. R. S., and Lecturer on Anatomy at St. George's Hospital Medical School. With Five Hundred and Twenty-two Engravings on Wood. With an introduction on General Anatomy, by T. HOLMES, M. D., Cantab. From the Eighth English Edition. To which is added, "Landmarks, Medical and Surgical." By LUTHER HOLDEN, F. R. C. S. Philadelphia. H. C. Lea.

The last American edition of this standard work was issued in 1870. The bringing of this volume up to the present status of microscopic anatomy, together with such additions to the science of anatomy as have been developed in the past eight

years, has required an enlargment of the new volume to the extent of over thirty pages.

Besides these additions very few changes have been made in the body of the work, for the very good reason that none were required.

The addition of "Holden's Landmarks" adds greatly to the practical value of the new edition and this feature will be fully appreciated by every student of anatomy. Grays Anatomy has long been preferred as a text book for students, but it must now supercede all other works upon this fundamental branch of medical science.

Rest and Pain. We have received from Wm. Wood & Co., of New York, a copy of "Rest and Pain." By Prof. Hilton.

This is the first volume of the series which is to comprise "Wood's Library of Standard Medical Authors." The book is printed on substantial paper, profusely illustrated and very tastefully bound. The publication of this series of valuable works for the excedingly low price of one dollar a volume, is a venture that can only be made remunerative by a very extensive sale.

We advise every dentist and physician to send to Wm. Wood & Co., 27 Great Jones street, New York, for circular containing erms, etc. No medical works of equal value have ever been published at anything near the small sum for which these books are offered. Subscriptions must be for the entire year, twelve volumes, as the books will not be sold separately.

Anhual Address before the American Academy of Medicine, 1878. By Frank H. Hamilton, A. M., M. D., LL. D., President or the Academy.

The Popular Science Monthly Suplemenmt for December, contains the following notable articles: "Recent Developments of Socialism in Germany and the United States;" "The Alcohol Question;" A Symposium by three of England's most noted physicians. "Malt Liquors—Their Effect on Digestion and Nutrition;" American Facts and Gladstone Fallacies," together with ten or twelve other articles of great interest to the general reader. We understand that the *Popular Science Monthly* will be enlarged after the close of the year. The *Supplement*, hereafter will be, in effect, consolidated with the *Monthly*. Nowhe

else will be found so much good scientific reading matter presented in a popular style for so little money. We understand that its circulation is rapidly increasing and is amply sufficient to justify the publishers, D. Appleton & Co., in the largely increased expense which they now assume in its publication. Price for consolidated monthly, $5.00 per annum.

MODEL HOMES.—We have received from the publishers, Messrs. Palliser, Palliser & Co., Architects, Bridgeport, Conn., a copy of a popular work entitled "Pallisers Model Homes."

We regard the work as a notable instance of what may be done by a skillful architect, towards adapting really elegant and tasteful designs, to the exigencies of moderate outlay. The work contains 18 designs for dwellings ranging in cost from $500 to $4,500. Any one who contemplates building cannot better invest one dollar than in the purchase of this small volume.

The same firm furnish a lithographed plan of a Model Gothic Cottage, including elevations, for 25 cents.

THE VOICE OF THE PEOPLE on the Silver question. A pamphlet of forty-three pages, containing able articles on the Money Power, the Finance Problem, etc., etc., by Dr. W. W. Allport, Henry G. Miller and J. H. Kedzie, of Chicago, and others resident in Illinois, Iowa and Kansas. A very exhaustive present ation of the folly, not to say the wickedness, of that class legislation which would enforce the single gold standard; at the same time the papers contrast this course with the wisdom of the practical introduction of the bi-metallic standard of currency.

THE PHYSIOLOGICAL ACTION of the muscles of the LOWER JAW, by Thomas Brian Gunning, M. D., New York; The LARYNX, the source of VOWEL SOUNDS, by the same author; also a PROTEST against the surrender to non-members of the DENTAL PROFESSION, of the right and duty of deciding upon the fitness of the Faculties of Dental Colleges.

THE SCIENTIFIC MAN, a weekly illustrated journal of popular science. Each number contains a scientific lecture by some eminent scientist, such as Roscoe, Huxley, Tindall, Carpenter and others, together with scientific notes and news. The subscription price is one dollar a year, or about two cents per numuer. Sample copy for two cents. Asa K. Butts, 19 Dey street, New York.

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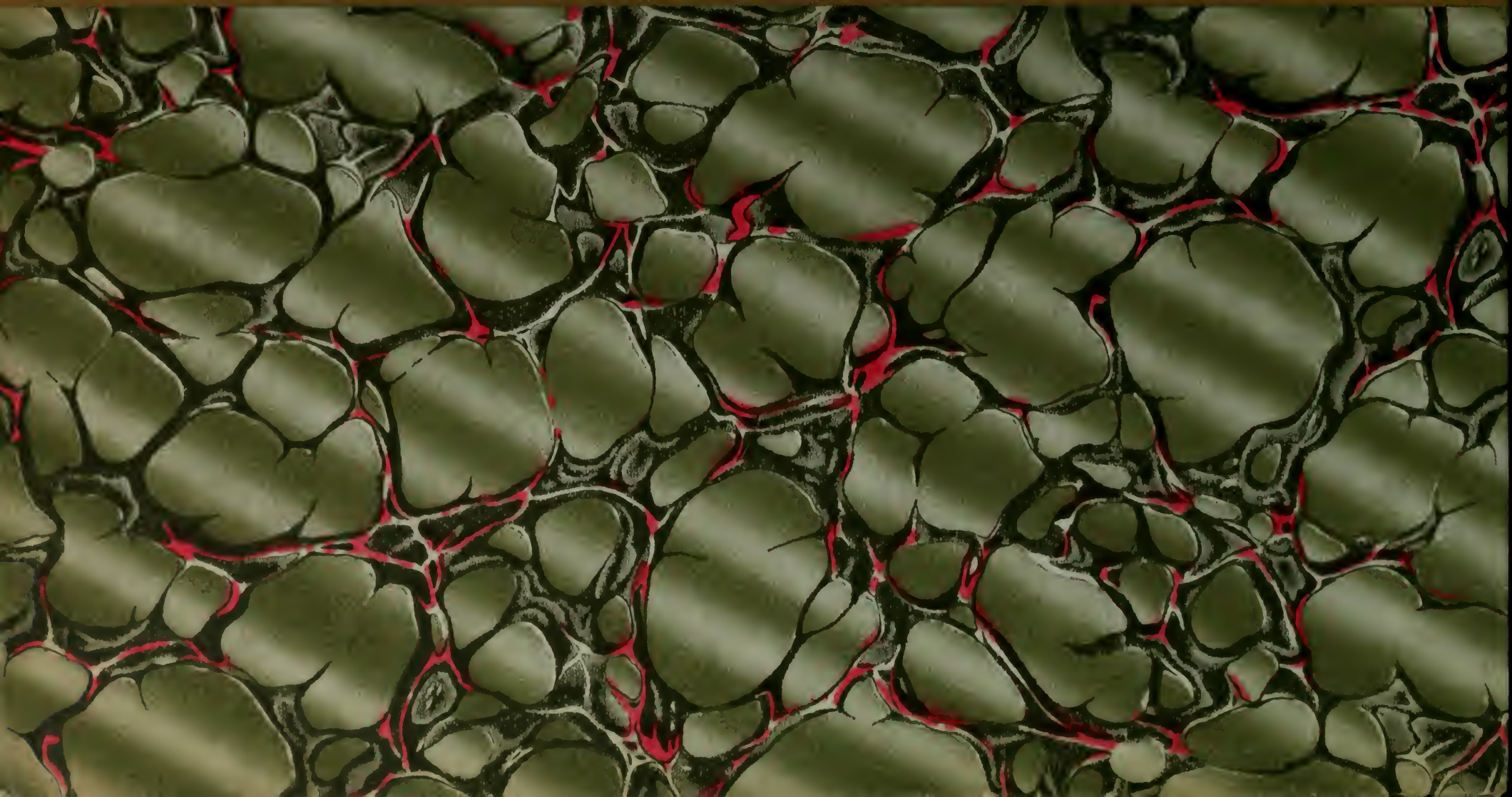
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